SONY

SDX-900V
SDX-900V/R 5.25”Model

Product Specification Manual

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NOTE:

This Product Specification Manual is applicable for AIT-4 drive.

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1. Introduction

1.1. About this Product Specification Manual

This Product Specification Manual is applicable for AIT-4 drive.

This manual provides information about the Sony SDX-900V series Advanced Intelligent Tape Drives which is necessary to integrate the drives into OEM products. This manual describes the specifications, SCSI Interface, diagnostics, operation and installation of the Sony AIT-4 Tape Drives.

The Sony SDX-900V drive uses data compression to achieve high capacity and high transfer rates. Actual capacity and transfer rate depends on the source file type. The capacity ratings listed in the next subsection are based on a 246 meter tape AIT-4 cassette. The Sony SDX-900V drive is a high capacity data storage device using Advanced intelligent tape (AIT) technology. The Sony SDX-900V drive achieves high data integrity through read-after-write, an additional level of Error Correction Code, and other features.

The Sony SDX-900V drives provide MIC technology that automatically enhance reliability and performance. The Sony SDX-900V drives provide read and write capability for MIC user data area.

1.2. Introducing the Sony AIT Technology

While magnetic storage technologies continue to push the envelope of recording density and provide higher capacities and transfer rates every 18 to 24 months, improvements in time to access this data have become very limited. Since 1990, tape recording densities have increased up to ten fold, while the time to access this data has increased less than two fold, creating a large mismatch between the amount of stored data and the ability to access it.

This large “gap” between data access latency and area density has created a dilemma in application development and limited the potential to implement truly cost-effective tertiary storage solutions. Many applications compensated for this deficiency by incorporating multiple redundant tape drives, at higher cost, to achieve an acceptable level of service for their users. Sony’s new Advanced Intelligent Tape design has recognized this need and provided an innovative approach to solving the data latency problem while increasing capacity and data transfer rates.

Traditional, older tape technologies relied mostly on conventional mechanical means, such as faster search speeds or an on-tape index to improve access to stored data. While improvements in electronics and magnetics have been the main enablers of increased capacity and transfer rates, rarely have these same technologies been employed to significantly improve access to data.

Sony’s Advanced Intelligent Tape (AIT) architecture has deviated from conventional designs and employed electronic enhancements to significantly improve access to stored data, using a captive, non-volatile memory chip contained within the magnetic data cartridge. Known as Memory-In-Cassette, or MIC, this memory chip provides a direct and immediate connection to the tape drive’s on-board processors to enable quick media load, fast access to user files and provide a wealth of data about the history and current state of the data cartridge.

1.3. Features of the Drive

Major features of the Sony SDX-900V include:

• Capacity

200 Gbyte typical when using 246 meter tape AIT-4 cassette (SDX4-200C)

520 Gbyte with 2.6:1 Data Compression

- Sustained transfer rate

  24 Mbyte/sec when using AIT-4 cassette

- Supported Format

  AIT-4 (Read/Write)

- Not compatible with the DDS and EXABYTE format tapes
- Burst transfer rate

  12 Mbyte/sec Asynchronous

  160 Mbyte/sec Synchronous

- Large 96 MB Buffer Memory
- 3.5” Standard Height, 5.25” Half Height
- Embedded SCSI interface (Ultra 160 LVD, Single-ended or Low Voltage differential)
- Supports Variable or Fixed record length
- Supports SCSI Disconnection/Arbitration
- Read After Write (RAW) On and Off capability
- Read Retry On and Off capability
- Fragment rewrite function – AIT-4
- Two levels of Error Correction Code (ECC) – AIT-4
- High Speed search (120 times nominal Read/Write speed)
- Random read, Append write
- MIC Support (Automatic reliability and performance enhancement.)
- MIC Support (Read and write capability for MIC user data area.)
- Remote-MIC Support
- Tape Alert

1.4. Reference

Please refer to the following documents for additional information:

•SCSI-2 [1]ANSI X3.131.-1996 Small Computer Systems Interface-2 (SCSI-2).

• SCSI Parallel Interface-2 (SPI-2) ANSI X3T10-1142D rev 20b.

ANSI X3T9.2/86-109 (Revision 10H, or above), available through ANSI.

• SCSI Parallel Interface-3 (SPI-3) ANSI INCITS 336-2000

• SCSI Architecture Model-2 (SAM-2) ANSI INCITS 366-2003

• ALDC - Adaptive Lossless Data Compression (ALDC) Algorithm;
ECMA-222, available through [2]ECMA.

1.4.1. How to get ECMA-222, 246, 291, 292, 329 Standard Document

You can get these ECMA Standard Document file from the following URL.

http://www.ecma-international.org/publications/standards/standard.html

[1] ANSI (American National Standard for Industry)

[2] ECMA (European Computer Manufacturers Association)

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2. Specifications

Physical, environmental and performance specifications for the SDX-900V and SDX-900V/R.

2.1. Specifications

2.1.1. Dimensions

The SDX-900V

Height	41.2 mm (1.62 in)	± 0.5 mm (0.02 in)
Width	101.6 mm (4.00 in)	± 0.5 mm (0.02 in)
Depth	155.0 mm (6.10 in)	± 0.5 mm (0.02 in)

The SDX-900V/R

Height	41.2 mm (1.62 in)	± 0.5 mm (0.02 in)
Width	146.0 mm (5.75 in)	± 0.5 mm (0.02 in)
Depth	155.0 mm (6.10 in)	± 0.5 mm (0.02 in)

Note: The above dimensions do not include the front panel thickness, eject button and SCSI connector.

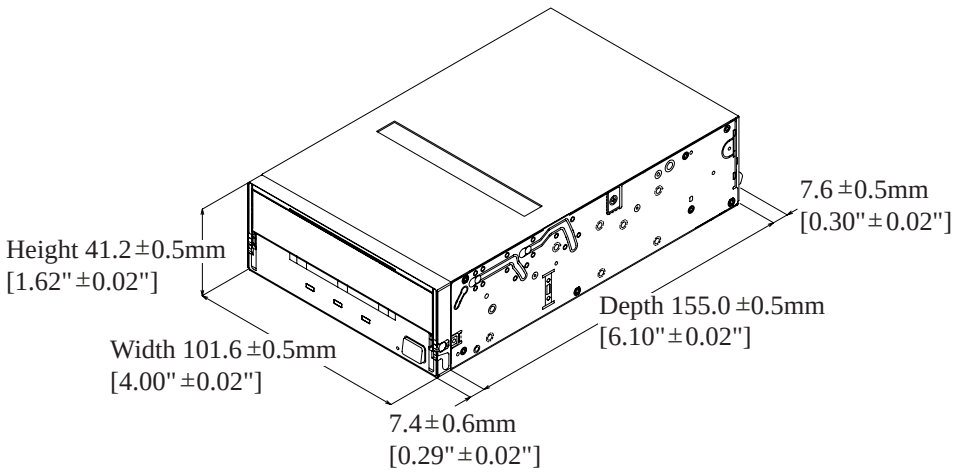


Figure 2-1: Dimensions (SDX-900V)

2.1.1.1. Mounting Holes

Figure 2-2a gives details of the mounting holes for the Sony SDX-900V and figure 2-2b for the Sony SDX-900V/R.

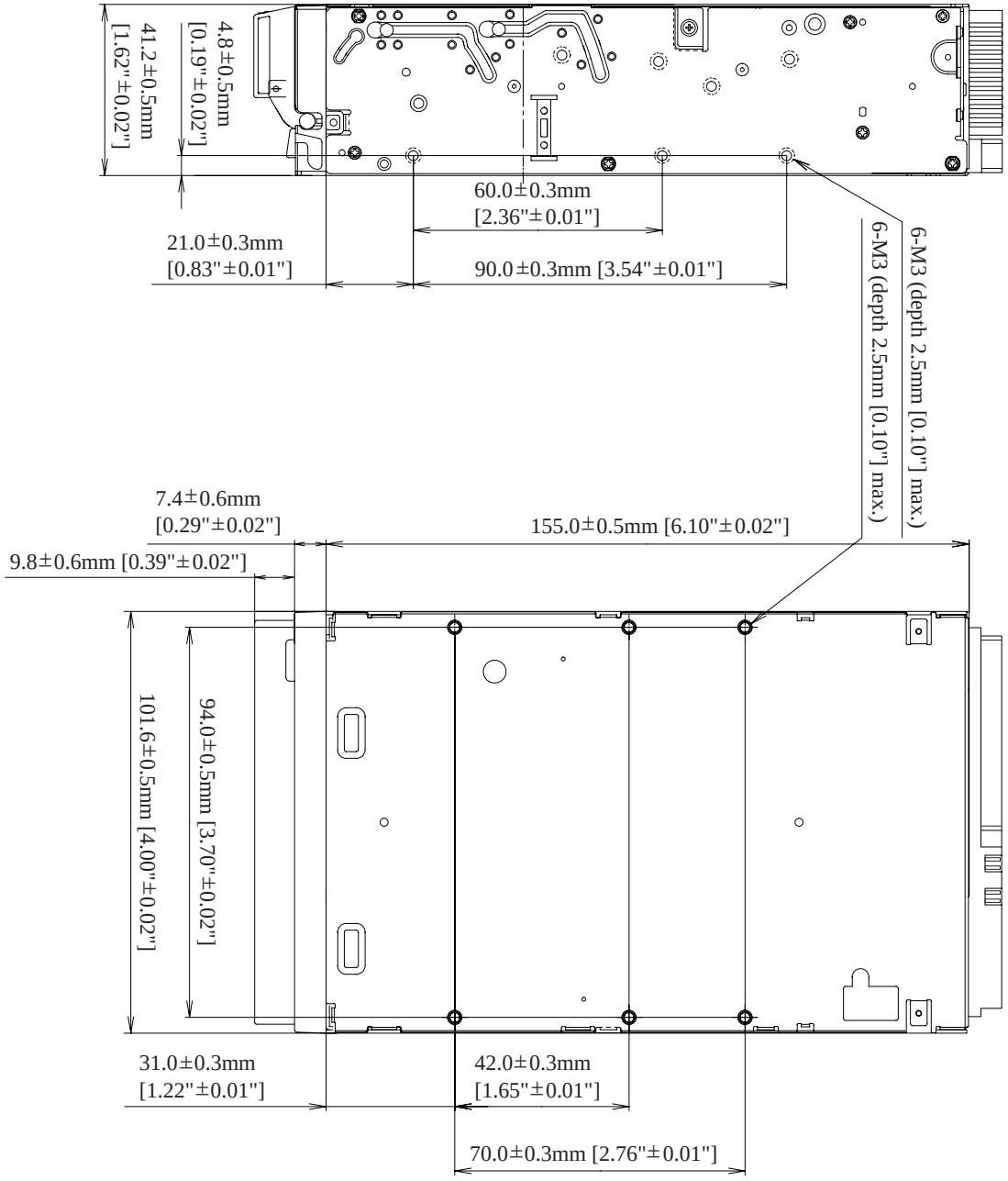


Figure 2-2a: SDX-900V Mounting Holes

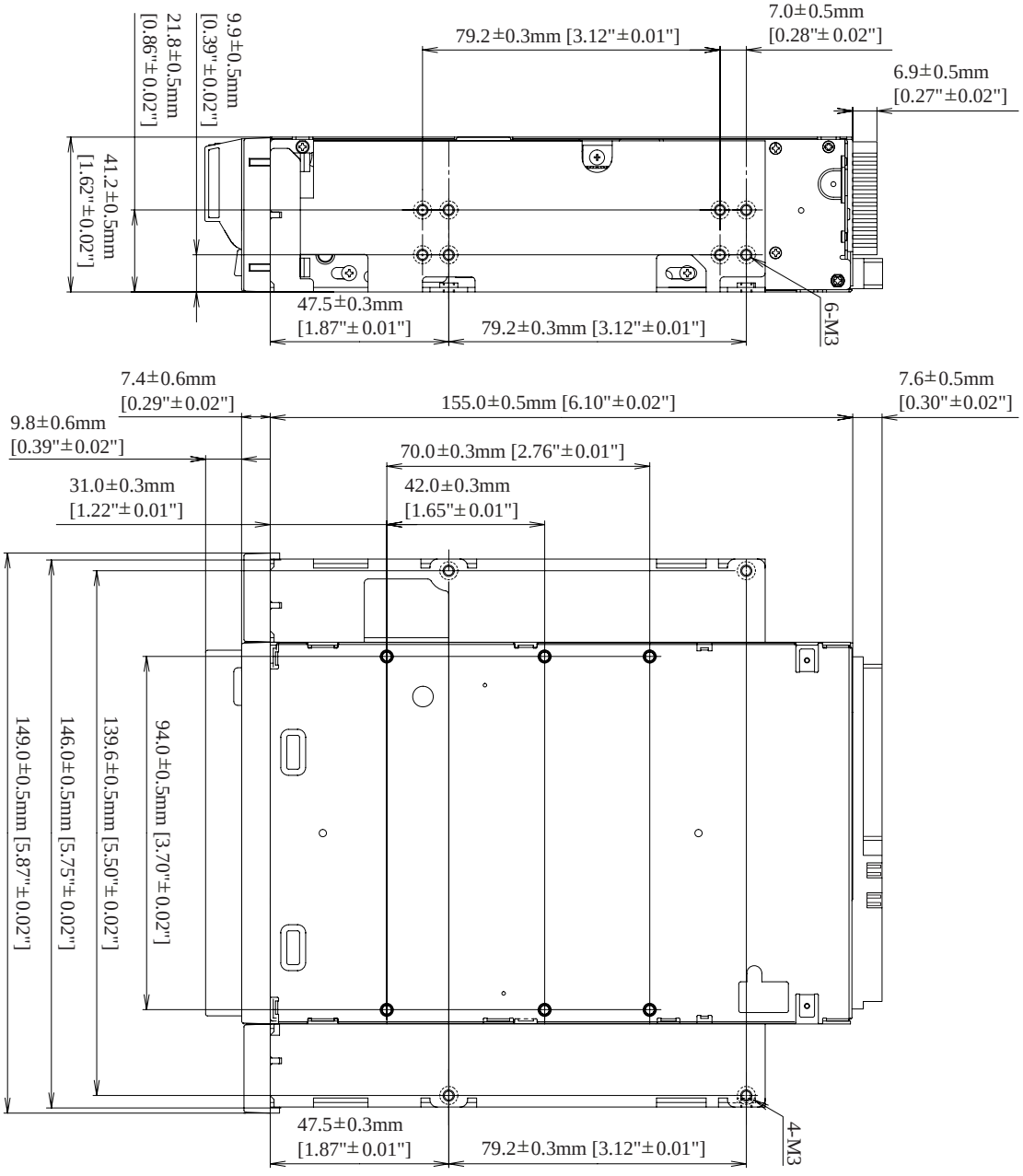


Figure 2-2b: SDX-900V/R Mounting Holes

2.1.2. Weight

SDX-900V	780 grams, without a cassette and a front bezel.
SDX-900V/R	1010 grams, without a cassette and a front bezel.

2.1.3. Connectors

The SDX-900V has a SCSI connector with a power connector and Jumpers at the positions shown in Figure 2-3. All other connectors are for use by Sony's manufacturing and service facilities only.

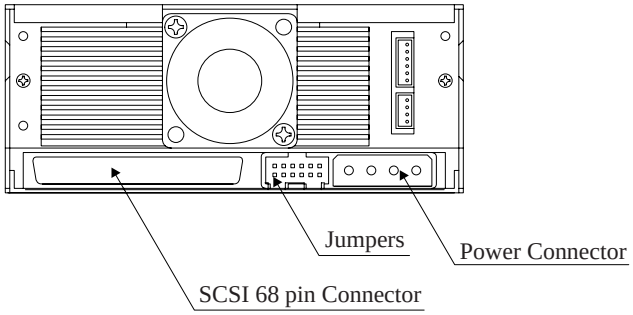


Figure 2-3: Connector Positions

2.1.3.1. SCSI Cables and Terminators

The Single-Ended SCSI configuration and Low-Voltage-differential SCSI configuration are supported by SDX-900V, and SDX-900V/R The hardware specification of this interface can be found in Clause 3. Physical Characteristics, of the X3T10/1142D (SCSI Parallel Interface2) standard. Only unshielded connectors are supported. Possible cable and connector sources are listed below. This does not imply that these are the only sources for SCSI accessories.

Note: When using high speed data transfer with the SDX-900V it is recommended that total length of the SCSI data cable not exceeded 1.5m for Single Ended SCSI configuration. As for Low-Voltage-differential SCSI configuration, less than 12m is recommended.

Cable	30 AWG Ribbon Hitachi UL 20848 (or equivalent)
Connector	AMP 1-786090-7 (or equivalent)

2.2. Environmental Specifications

The specifications which apply when media is present may be different than these.

2.2.1. Temperature and Humidity Range

Temperature

Operating	5 ºC to 40 ºC (ΔT < 10 ºC/h)
Non-Operating(mech.)	-40 ºC to 70 ºC (ΔT < 20 ºC/h)
Non-Operating(tape)	-40 ºC to 45 ºC (ΔT < 20 ºC/h)

Humidity

Operating	20 to 80% RH, non-condensing Maximum wet bulb temperature = 26 ºC
Non-operating (mech.)	5 to 95%RH(ΔRH<30%/h) Maximum wet bulb temperature = 45 ºC
Non-operating (tape)	20 to 80%RH(ΔRH<30%/h)

.

2.2.2. Altitude

Operating	0 to 10,000 feet

2.2.3. Suspended Particulate

Operating	Less than 150 microgram/m^3 Based Sampling period 24 hours

2.2.4. Vibration

Operating	Swept Sine 5 to 500Hz, @0.25G Peak 1 Octave/min. 3 axis, 3 directions
Non-operating	Swept Sine 5 to 500Hz, @ 0.5G Peak 1 Octave/min. 3 axis, 3 directions

2.2.5. Shock

Operating	No Data Loss Half Sine Performance 5 G Peak 3 ms 3 axes, 3 directions *Interval 10 seconds
Non-operating	No Device Damage Half Sine 90 G Peak 3 ms (30 G Peak 11 ms) 3 axes, 3 directions *Interval 10 seconds

2.2.6. Acoustic Noise

The ambient noise level is no greater than 25 dB (A). The sound-meter on (A) scale is located 1m in front of the center of the drive front panel. (A): A curve weight

Streaming Write/Read	35dB(A)
Insert/Eject	60dB(A)

2.2.7. EMC

EMI/EMS	Radiated Emissions / Conducted noise Emissions	EN 55022 / 94 + EN 55022 A1 / 95 class B
EMS	ESD (Front Panel Only, integrated product)	Discharge Voltage Less than 15kV: No operation failure Less than 20kV: No drive damage

2.2.8. Orientation

The SDX-900V can be installed in three different mounting positions as shown in the figure below. Each position has a maximum tolerance of ± 10 degrees.

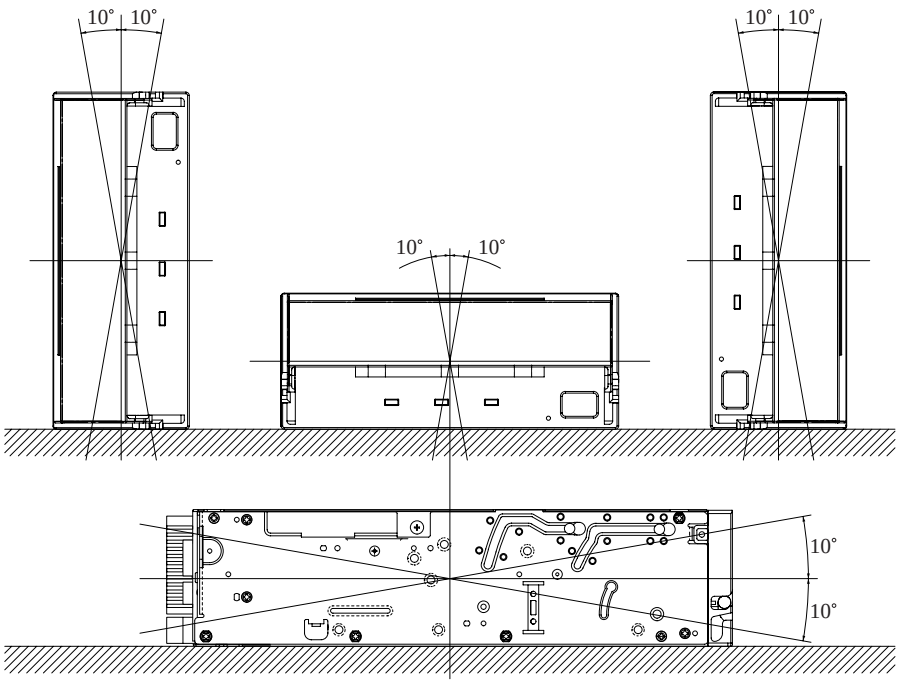


Figure 2-4: Mounting Attitude and Tolerance

2.3. Performance Specification

The data capacity, data transfer rate and data reliability specifications this chapter require the media to conform to the AIT-4 Media Specification and also require the drive and media to remain within their respective operating and non-operating environmental specifications. The specifications below also assume that the C3 ECC fragment (AIT-4) is generated on writing and used as necessary on reading, and further assumes that read-after-write rewrites are used as necessary on writing.

2.3.1. Data Capacity

The SDX-900V includes a data compression capability. When data compression is enabled the drive capacity can increase from 2 times to 3 times. The efficiency of the data compression depends on the actual data that is being compressed and cannot be predicted precisely prior to compression.

Format	AIT-4 Standard Format	
Native Capacity	200.0 Gbyte typical	When using 246 meter tape AIT-4 cassette (SDX4-200C)

2.3.2. Data transfer Rate

2.3.2.1. Sustained Data Transfer Rate to and from the Tape

The sustained transfer rate to and from the tape is 24Mbyte per second with AIT-4 cassette. For this sustained rate to be achieved, the drive must be streaming. There may be some dependency on the host for this to be achieved. When data compression is enabled the drive can achieve a transfer rate from 48Mbyte per second to 72Mbyte per second with AIT-4 cassette.

2.3.2.2. Burst Transfer Rate to and from the SCSI Bus

The SDX-900V will transmit and receive data bursts to and from the SCSI bus at a maximum burst rate of 12Mbyte per second, using Ultra 160 asynchronous transfers and maximum of 160Mbyte per second, using Ultra160 synchronous transfers.

2.3.3. Initialize Time

Initialize Time means the period from the time the drive is powered on to the time when the drive is ready and waiting for a SCSI command such as INQUIRY or TEST UNIT READY. Initialize Time is less than 5 seconds.

The drive will respond with BUSY status until the completion of the Initialize Time. The Initialize Time does not include the time necessary for drive diagnostics to complete and the drive to become ready for tape insertion.

2.3.4. Load Time

Load Time means the period from the time when the operator inserts a cassette into the drive to the time when the drive is ready. The data in the below table represents the average time for SDX-900V. The time it may take for retrying is not reflected here.

	SDX4-200C (246 m)
Load Time	14 sec

2.3.5. Unload Time

Unload Time means the period from the beginning of the unload sequence caused by Unload Command or Eject button to the time when a cassette is ejected from the slot. Unload Time does not include Rewind time. The data in the below table represents the average time for SDX-900V. The time it may take for retrying is not reflected here.

	SDX4-200C (246 m)
Unload Time	24 sec

2.3.6. Search Time

Search Time means the period for the drive to find the position that is required by a command. This time also depends on the tape length and the position of the head along the tape. The data in the below table represents the average time for SDX-900V. The time it may take for retrying is not reflected here.

	SDX4-200C (246 m)
Search Time	130 sec

2.3.7. Rewind Time

Rewind Time means the period from the beginning to the end of rewinding sequence. This value depends on the tape length and the position of the head along the tape. The data in the below table represents the average time for SDX-900V. The time it may take for retrying is not reflected here.

	SDX4-200C (246 m)
Rewind Time	115 sec

2.3.8. Error Rate

The un-correctable bit error rate is expected to be less than 1 in 10 to the 17th.

2.3.9. Retry Limits on Rewrites

AIT-4
For Read-after-Write error correction, each group can be rewritten up to a maximum of 14 times giving 15 times of the group.

2.3.10. Definition of Failure

A failure is defined as any permanent manufacture of the drive that prevents the user from retrieving data from tape. This includes failure to power up, failure to unload or eject a cassette, or failure to write and read data to and from the tape, providing that both the drive and tape are being used within specification.

Faults are not considered failures when they are related to operator error mishandling and abuse, system-related faults (cabling problems unsupported systems, operating software and so on) no trouble found, and transportation damage.

2.3.11. Mean Time Between Failures

The Mean Time Between Failures (MTBF) for the SDX-900V is 400,000 power-on hours, assuming a duty cycle of 100%, where:

$$DutyCycle = \frac{Tape\ \ Motion\ \ Time}{PowerOn\ \ Time} \times 100$$

2.3.12. Mean Time to Repair

The Mean Time To Repair (MTTR) of the SDX-900V is 30 minutes. Since at the field level the entire drive is considered a Field Replaceable Unit (FRU) the time to replace the drive with a new one is less that 30 minutes.

2.3.13. Component Life

The specified life of the SDX-900V is 5 years average.

2.3.14. Durability

The durability of the components in the SDX-900V will exceed the number of operations listed on the following table:

Start/Stop	400,000 times
Reposition	3,000,000 times
Thread/Unthread	100,000 times
Load/Eject	100,000 times

2.4. Safety

The SDX-900V conforms to the following safety standards:

• UL/cUL (Underwriters Laboratories, Inc.)
UL 60950 3rd Edition/CSA C22.2 No. 60950-00
Safety of Information Technology Equipment.

• TUV
IEC 950 Safety of Information Technology Equipment including
Electrical Business Equipment (First Edition)

• CE Mark

2.4.1. Conditions of Acceptability

The SDX-900V is for use only in equipment where the suitability of the combination has been determined by an appropriate certification organization (for example, Underwriters Laboratories, Inc. or the Canadian Standards Association in North America, and the British Standards Institution or Verband Deutscher Elektrotechniker in Europe). Other considerations include the following:

1. An enclosure must be supplied to limit the operator's access to live parts, to provide system stability, and to furnish the drive with the necessary grounding integrity.
2. The necessary voltage supplies must be provided. These supplies are Extra Low Voltage SEC for UL and CSA, or Safety Extra Low Voltage for BSI, VDE, and so on, of +5V and +12V DC.

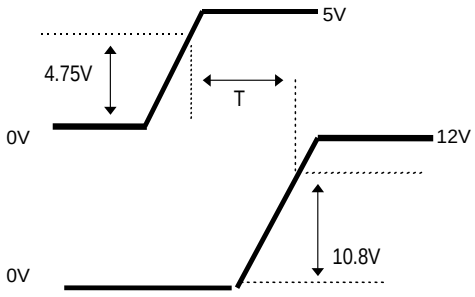
2.5. Installation Requirements

Note: Do not move the drive while it is operating. It may cause malfunction.

2.5.1. Power Requirements

Voltage	Max Ripple	Current	
		Typical	Maximum
5V ± 5%	100 mV p-p	1.5A	2.5A
12V ± 10%	150 mV p-p	0.75A	3.0A

* exclude SCSI terminator power



-300 ms ≤ T ≤ 300 ms

Figure 2-5: Power-up Sequence

Note: Voltage has to increase constantly during Power-up until Maximum is reached.
Do not turn off the drive while the tape is in the drive.

2.6. Data Compression

The tape capacity is increased by compressing data prior to writing it to the tape. Data compression is a well established technology for reducing the number of bits used to represent data in order to improve data transfer rate as well as reduce the amount of storage space consumed by the data. The compression ratio depends on the source file type. The SDX-900V uses the ALDC Data Compression algorithm. ALDC is ECMA standard data compression algorithm. (ECMA-222) The Data Compression control page allows the host computer to enable data compression and decompression and also configure the way in which the drive responds to compressed/uncompressed data boundaries on the tape. The AIT-4 Format allows both compressed and uncompressed data to reside on the same tape.

The Sony SDX-900V has a DIP switch to disable the Data Compression/ Decompression. After power-on reset with this DIP switch set, both data compression and data decompression are disabled However, a MODE SELECT command can override the setting of this DIP switch. After power-on reset without this DIP switch set, both data compression and data decompression are enabled. (See clause 3.1.4)

3. Installation

3.1. Installation Guide

This Product Specification Manual is applicable for AIT-4 drive.

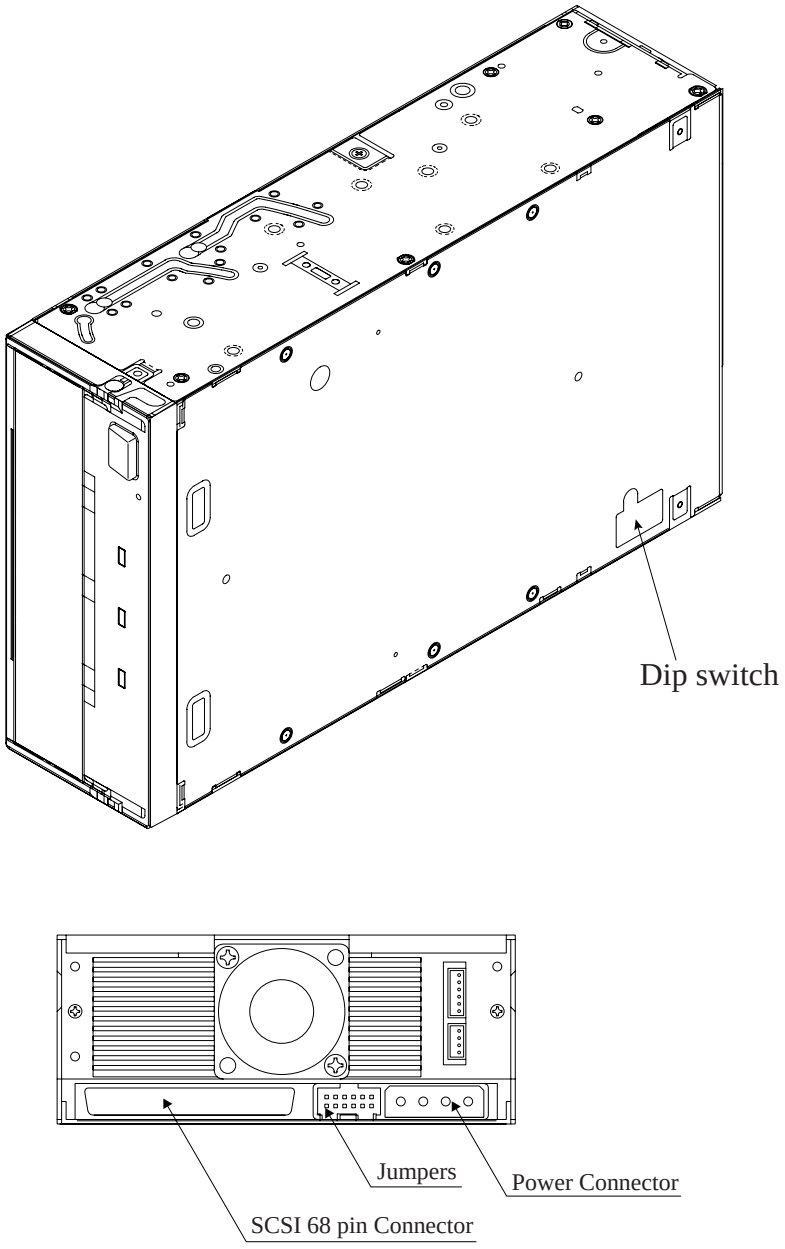
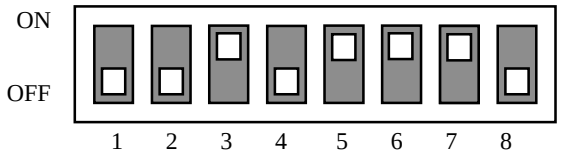


Figure 3-1: DIP switch & Connector



1 DR (Desaster Recovery) Mode
2 Emulation Mode
3 AIT Library Interface Mode
4 Reserved
5 Terminator Power (ON)
6 Periodic Cleaning Req (ON)
7 DC Control-1
8 DC Control-2

Figure 3-2: DIP Switch Positions

Table 3-1: Drive Mode

DIP SW	1	2	3	4	MODE
	OFF	OFF	ON	OFF	Normal
	ON	OFF	OFF	OFF	DR Mode
	OFF	ON	OFF	OFF	SDX-700C Emulation Mode
	OFF	OFF	ON	OFF	Library Mode

Table 3-2: Periodic Cleaning Request (Refer to 4.6.1.2)

DIP SW 6	Definition
OFF	Disable Periodic Cleaning Request
ON	Enable Periodic Cleaning Request

3.1.1. SCSI ID Number Jumper

The SCSI ID number of the SDX-900V is selected by the SCSI ID number jumpers. The figure below shows the jumper configuration for each of the possible SCSI IDs.

SCSI	ID3	ID2	ID1	ID0
0	:	:	:	:
1	:	:	:	|
2	:	:	|	:
3	:	:	|	|
4	:	|	:	:
5	:	|	:	|
6	:	|	|	:
7	:	|	|	|
8	|	:	:	:
9	|	:	:	|
10	|	:	|	:
11	|	:	|	|
12	|	|	:	:
13	|	|	:	|
14	|	|	|	:
15	|	|	|	|

: = OPEN Jumper not installed
| = CLOSED Jumper installed

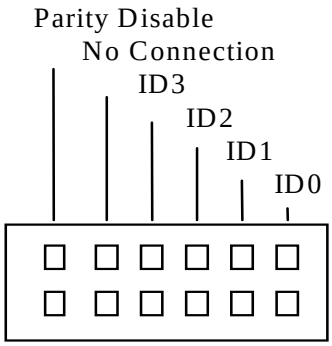


Figure 3-3: Jumper positions

3.1.2. Termination Power Switch

Position 5 of DIP switch is used to set whether SDX-900V provides the termination power to pin 17,18,51,52 on SCSI bus, or not.

3.1.3. Parity Disable Jumper

Parity check function can be disabled by Jumper. Parity check is disabled while left end jumper is installed. Parity generate function is always enabled.

Parity	Setting
Disable	|
Enable	:
: = OPEN	Jumper not installed
| = CLOSED	Jumper installed

3.1.4. Data Compression ON Switch

Data compression can be selected by DIP switch.

Table 3-3: Data Compression Switches

DC Control-1	DC Control-2	Definition
OFF	OFF	Compression disabled at power-on. The host is allowed to control compression.
OFF	ON	Compression disabled at power-on. The host is not allowed to control compression.
ON	OFF	Compression enabled at power-on. The host is allowed to control compression.
ON	ON	Compression enabled at power-on. The host is not allowed to control compression.

3.1.5. Power Connector

The power connector is illustrated as Figure 3-4.

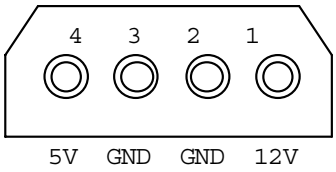


Figure 3-4: Power Connector

3.1.6. SCSI 68 pin Connector

Figure 3-5 illustrates SCSI 68 pin connector, and table 3-4 shows the assignments for the pins of the connector.

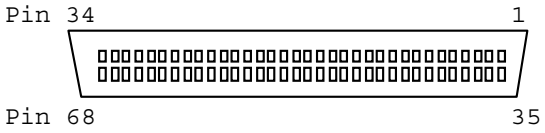


Figure 3-5: Non-shielded SCSI Device Connector

SDX-900V supports both Low-Voltage-Differential SCSI configuration as shown table 3-4 and Single-Ended SCSI configuration as shown table 3-5. SDX-900V detects and switches SCSI configuration between Low-Voltage-Differential and single-ended modes by monitoring DIFFSENS signal assigned pin 16 in SCSI bus. (Refer to table 3-4)

Table 3-4: SDX-900V SCSI Signals
(Low-Voltage-Differential Type BUS P Cable Signal Assignment)

Signal Name	Cable Conductor Number		Signal Name
-DB(12)	35	1	+DB(12)
-DB(13)	36	2	+DB(13)
-DB(14)	37	3	+DB(14)
-DB(15)	38	4	+DB(15)
-DB(P1)	39	5	+DB(P1)
-DB(0)	40	6	+DB(0)
-DB(1)	41	7	+DB(1)
-DB(2)	42	8	+DB(2)
-DB(3)	43	9	+DB(3)
-DB(4)	44	10	+DB(4)
-DB(5)	45	11	+DB(5)
-DB(6)	46	12	+DB(6)
-DB(7)	47	13	+DB(7)
-DB(P)	48	14	+DB(P)
GROUND	49	15	GROUND
GROUND	50	16	DIFFSENS
TERMPWR	51	17	TERMPWR
TERMPWR	52	18	TERMPWR
RESERVED	53	19	RESERVED
GROUND	54	20	GROUND
-ATN	55	21	+ATN
GROUND	56	22	GROUND
-BSY	57	23	+BSY
-ACK	58	24	+ACK
-RST	59	25	+RST
-MSG	60	26	+MSG
-SEL	61	27	+SEL
-C/D	62	28	+C/D
-REQ	63	29	+REQ
-I/O	64	30	+I/O
-DB(8)	65	31	+DB(8)
-DB(9)	66	32	+DB(9)
-DB(10)	67	33	+DB(10)
-DB(11)	68	34	+DB(11)

Table 3-5: SDX-900V SCSI Signals (Single-Ended Type BUS P Cable Signal Assignment)

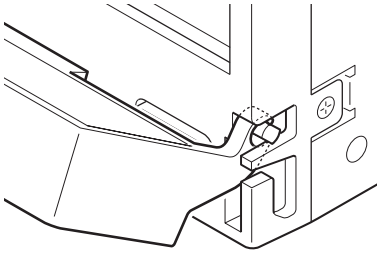
Signal Name	Cable Conductor Number		Signal Name
-DB(12)	35	1	GROUND
-DB(13)	36	2	GROUND
-DB(14)	37	3	GROUND
-DB(15)	38	4	GROUND
-DB(P1)	39	5	GROUND
-DB(0)	40	6	GROUND
-DB(1)	41	7	GROUND
-DB(2)	42	8	GROUND
-DB(3)	43	9	GROUND
-DB(4)	44	10	GROUND
-DB(5)	45	11	GROUND
-DB(6)	46	12	GROUND
-DB(7)	47	13	GROUND
-DB(P)	48	14	GROUND
GROUND	49	15	GROUND
GROUND	50	16	GROUND
TERMPWR	51	17	TERMPWR
TERMPWR	52	18	TERMPWR
RESERVED	53	19	RESERVED
GROUND	54	20	GROUND
-ATN	55	21	GROUND
GROUND	56	22	GROUND
-BSY	57	23	GROUND
-ACK	58	24	GROUND
-RST	59	25	GROUND
-MSG	60	26	GROUND
-SEL	61	27	GROUND
-C/D	62	28	GROUND
-REQ	63	29	GROUND
-I/O	64	30	GROUND
-DB(8)	65	31	GROUND
-DB(9)	66	32	GROUND
-DB(10)	67	33	GROUND
-DB(11)	68	34	GROUND

3.1.7. Attaching and Removing the Dust Cover

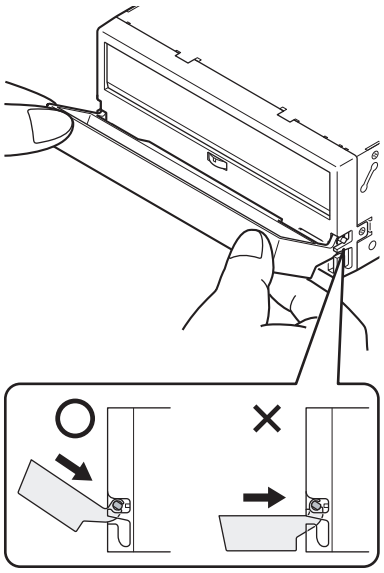
3.1.7.1. Attaching the Dust Cover

(1) Align the dust cover's hinge clips (one on each side) with the pins of the drive bezel.

- The dust cover should be positioned so that the six magnets on the cover's back face the drive bezel.
- Holding the dust cover at an angle as shown in the figure below, set the hinge clips on top of the bezel pins, positioning them so that they bracket the pins.



(2) Press down at an angle on each side in turn until you hear the hinge clips click into place.



Caution:

Do not press the dust cover in horizontally from the side. Doing so could cause the dust cover to break.

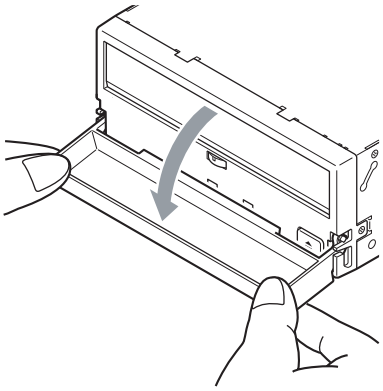
(3) Close the dust cover.

This completes attachment of the dust cover.

3.1.7.2. Removing the Dust Cover

(1) Open the dust cover.

(2) Holding the dust cover at both corners, carefully raise the dust cover.
The dust cover hinge clips and drive bezel pins uncouple.



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4. Operation

4.1. Summary of LED Indications

The SDX-900V have 3 LEDs. Each LED shows "Tape Motion", "Cleaning Request", and "Replace Tape" as defined.

"Tape Motion" to show the tape motion in the drive.

"Cleaning Request" to be on, when CLEANING is required.

"Replace Tape" to be on, when the tape needs to be replaced. It should be on when a medium error occurred.

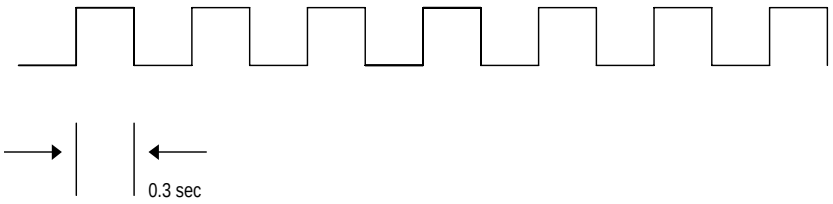
All of three LEDs flash fast simultaneously, when the drive is in malfunction.

The following table shows the meaning of each LED indications:

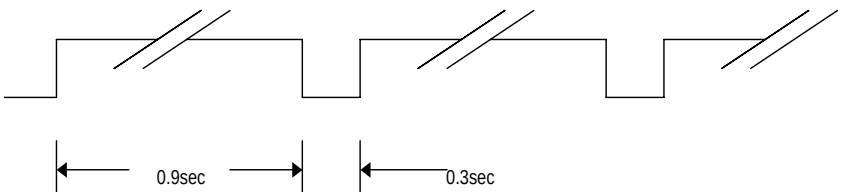
Table 4-1: Meaning of each LED indications

LED	Tape Motion	Cleaning Request	Replace Tape
Off	No Tape	Cleaning is Not Necessary	No Media Error Occurred
On	Tape Loaded	Cleaning Request	Media Error Occurred
Flash Slowly	Tape Access in Progress (Write/Read)	Cleaning is Not Completed	Media Warning
Flash Fast	Tape Access in Progress (Others)		
All LED Flash Fast	H/w Error Occurred		

Flash Fast (0.3sec on/ 0.3sec off)



Flash Slowly (0.9sec on/ 0.3sec off)



The following table shows the LED indication for each drive status/condition:

4.2. Operator Action

4.2.1. Powering up the SDX-900V

After the initial installation of the SDX-900V has been verified, power can be applied to the unit. The +12V and +5V power must be applied simultaneously. (See Figure 2-5) The SDX-900V will execute a power-up diagnostic and then comes ready.

Once the tape has been loaded the SDX-900V sends a CHECK CONDITION response on receipt of the next SCSI command from the host. The UNIT ATTENTION key is set in the returned REQUEST SENSE data to indicate that the tape may have been changed. (Sense Key/ASC/ASCQ = 06/28/00)

4.2.2. Inserting Cassettes

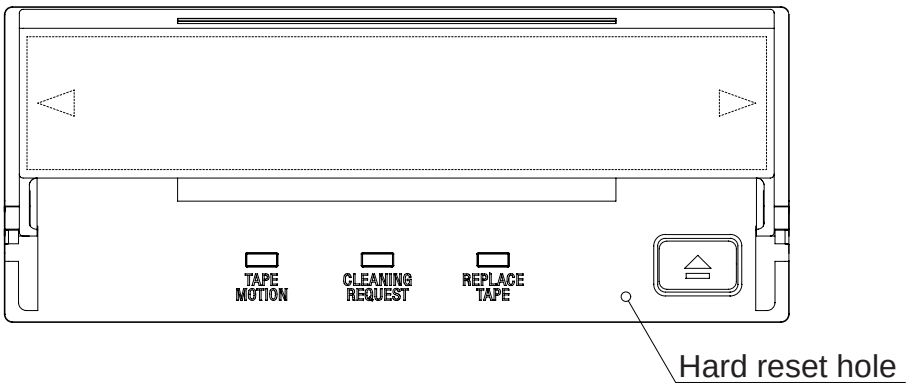
The operator inserts a cassette into the slot on the front panel. As the cassette is inserted, the drive takes it and automatically loads it into the drive mechanism. The SDX-900V performs a tape load sequence as described in clause 4.3.1

4.2.3. Removing Cassettes

The cassette can be removed from the SDX-900V either in response to a SCSI UNLOAD command, or by pressing the Eject button. The operator uses the Eject button to initiate the unload sequence (see clause 4.3.2). The mechanism winds the tape to Beginning of Media (BOM), unthreads it, and ejects the cassette from the slot.

Operation of the Eject button is disabled if the host has previously sent a SCSI PREVENT ALLOW MEDIA REMOVAL command with prevent bit set to one. In this case, pressing the Eject button has no effect, and does not initiate an Unload sequence. The Eject button returns to normal operation following receipt of an PREVENT ALLOW MEDIA REMOVAL command with prevent bit clear.

4.2.4. Hard Reset Hole

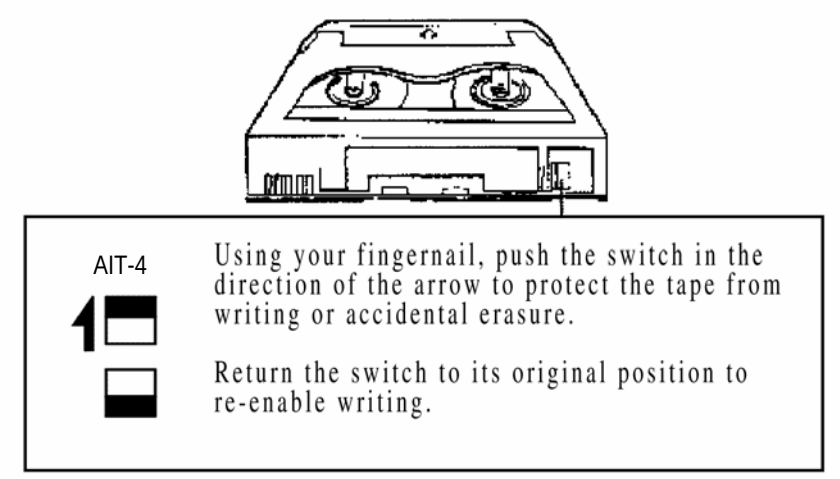


In case of emergency, you can immediately reset the drive itself by pushing the switch in the “Hard Reset Hole” with the tip of a pin. However, there is a risk of losing data upon execution of this operation in the Write or Read mode. The hardware reset operation is only for manufacturing and repair purposes.

4.2.5. Write-Protecting Cassettes

Cassettes can be write-protected by sliding the tab on the back of the cassette open. In this state, data can be read from the tape but not written to it.

Caution: The Tape Log, which contains a history of usage of the tape, will not be updated when the cassette is write-protected. It follows that the Tape Log becomes inaccurate if a cassette is used write-protected, and the media warning cannot be relied on to indicate that the cassette needs to be copied and replaced.


AIT-4
Using your fingernail, push the switch in the direction of the arrow to protect the tape from writing or accidental erasure.
Return the switch to its original position to re-enable writing.

4.3. Internal Function

4.3.1. The Load Sequence (Effective for non MIC cassette, only) Refer to 12.2.1. Fast Media Load/Unload (Effective for MIC cassette, only)

During load sequence, the following occurs:

(1) The drive mechanism accepts the cassette and threads the tape. The tape is then moved to Beginning-of-Tape(BOT) and the Reference area is checked to find the tape format. If the format is not AIT-4, the drive rewinds the tape to BOT and awaits either a Write, Partitioning, Mode Select or an UNLOAD command.

(2) The System area is then accessed and the System log is read into the drive.

(3) Finally the drive goes on-line.

4.3.2. The Unload Sequence (Effective for non MIC cassette, only) Refer to 12.2.1. Fast Media Load/Unload (Effective for MIC cassette, only)

The drive will always write any buffered data out to tape followed by an EOD prior to initiating the Unload sequence.

During this sequence the tape is rewound to BOT and, if the tape is write-enabled, the copy of the tape log held in RAM is written back to tape. The tape is then rewound to BOM and the tape unthreaded from the mechanism. At this stage the tape is either retained in the drive or ejected, depending on media removal is enabled by the Prevent Allow Media Removal command.

In the case of two partition tape the drive detects that the tape has been formatted as a two partition tape when the Reference Area is read during the load sequence. When the Unload operation begins the drive will then automatically update the Tape Log for each partition before unloading the tape.

4.3.3. Power-Fail or SCSI Reset Handling

If there is a power-fail, the SDX-900V performs the following actions, and reverts to its default configuration:

(1) The drive remains positioned at the point where the power-fail or SCSI Reset occurred.

(2) It executes the Power-Up sequence of self-tests. (When power is restored.)

(3) The drive returns CHECK CONDITION status for the first command after the power-fail or Reset. The next command from the initiator should be a REQUEST SENSE. The drive will return sense data including a sense key that will indicate that the drive has been reset. (Sense Key / ASC / ASCQ = 06/29/00)

4.3.4. Diagnostic and Normal Status Displays

This chapter describes LED displays while the SDX-900V is starting up. When power is turned on, the SDX-900V will go through its diagnostics to reach normal status. When a failure is detected during diagnostics, the LEDs show that the SDX-900V is out of order and needs to be repaired.

Note: When power is turned on, the all LED on before the front panel test.

4.3.4.1. Diagnostic Status Display

The SDX-900V starts with its Diagnostic function. This is made up of the Front Panel Test and the Kernel Test.

Front Panel Test

LED display sequence:

	TAPE MOTION	CLEANING REQUEST	REPLACE TAPE	
0.3sec	on	on	on	
0.3sec	-	-	-	
0.3sec	on	on	on	
0.3sec	-	-	-	Front Panel Test
0.3sec	on	-	-	Kernel Test
0.3sec	-	on	-	
0.3sec	-	-	on	
0.3sec	on	-	-	
0.3sec	-	on	-	
0.3sec	-	-	on	
0.3sec	on	-	-	

This function is for checking TAPE MOTION, CLEANING REQUEST and REPLACE TAPE LEDs and the related circuits. No errors can be generated as this test is only for operator verification of indicator operation.

Kernel Test

After the Front Panel Test, the SDX-900V checks its internal units. When a Diagnostic error occurs, the SDX-900V must be powered off. The SDX-900V will not work and should be checked or repaired immediately.

The purpose of the diagnostic firmware to test the SDX-900V electronics for functionality. If the diagnostic request comes from the host through SCSI, then the results are reported through SCSI.

If the electronics are not functioning, the diagnostic firmware tries to isolate the non-functional area to a specific Failed Unit. Given a failure, the firmware decides on a hierarchical basis which Unit to designate as the Most Suspect Failed Unit (MSFU). The confidence in this decision is intended to be 95%. For the details of Diagnostics, see clause 7.2.6

4.3.4.2. Normal Status Display

After the Diagnostic Display, when no failures are detected, the SDX-900V is in the Normal Status. The LEDs show various Normal Status (No Error) indications as shown in the table below:

Table 4-2: Normal LED indications

LED	Tape Motion	Cleaning Request	Replace Tape
Off	No Tape	Cleaning is Not Necessary	No Media Error Occurred
On	Tape Loaded	Cleaning Request	Media Error Occurred
Flash Slowly	Tape Access in Progress (Write/Read)	Cleaning is Not Completed	Media Warning
Flash Fast	Tape Access in Progress (Others)		
All LED Flash Fast	H/w Error Occurred		

4.4. Tape Alert

1. Tape Alert is a new specification for tape drive and library diagnostics. With this specification, any storage software application can access detailed device diagnostic information and interpret the information in a standard way.
2. Tape Alert information shall be accessed using LOG SENSE page 2Eh. Tape Alert configuration shall be performed using MODE SELECT page 1Ch. The MODE SENSE and MODE SELECT configuration of the Tape Alert interface is compatible with the information exceptions control page (1Ch). The application client shall first check the tape drive to determine whether it supports the Tape Alert log page (0x2Eh). The default application client access to the Tape Alert log page shall be performed using a polling method, with the page control bits in the LOG SENSE command set to 00h.
3. At minimum, the Tape Alert log page shall be read from the tape drive/autoloader device for the following:
    a. At the beginning of a Write/read job, even if the media is not loaded
    b. Immediately after an unrecoverable error during the write/read job
    c. At the end of each tape when the write/read job spans multiple tapes. If the tape is to be ejected then the log page shall be read before the tape cartridge is ejected
    d. At the end of a write/read job
4. The application client may also poll the Tape Alert log page at regular intervals (e.g. every 60 seconds) while the tape drive is idle. The application client may use the Tape Alert mode page (1Ch) to configure other access methods, depending on what options are supported by the tape drive.
5. Each time the application client reads the Tape Alert log page, it shall check all 64 flags to discover which are set (there may be more than one). The definitions of the 64 flags are device type specific. There is one definition for tape drive/autoloader devices, and a different definition for stand-alone changer devices (in libraries). For each flag set, the application client shall communicate the defined error message and severity for that flag to the user and log it. If multiple flags are set simultaneously, they shall be displayed together in ascending order of severity. The information read in the Tape Alert flags shall not in itself cause the application client to stop a current backup or restore operation.

4.5. Tape Format

The SDX-900V is an implementation of the Advanced Intelligent Tape (AIT-4) format, a standard developed by Sony for 8mm data storage drives.

AIT-4

- C1, first level Error Correction Code, providing correction for random and Burst Symbol errors.
- C3 ECC, third level Error Correction Code, providing correction across frames within groups
- Read-After-Write, where data is verified immediately after it is written and re-written if there is any error.
- Randomizer, to reduce inter-symbol interference.

4.6. Maintenance, Troubleshooting and Service

4.6.1. Head Cleaning

In case of SDX-900V,a cleaning function which prevents and recovers from head contamination is built in the drive. However, to keep optimum Read/Write performance, cleaning cassette is recommended to use.

4.6.1.1. Message When Cleaning Cassette is Necessary

When drive displays cleaning cassette requirement, (Cleaning Request LED is on or in case of SCSI, CLN bit is set at Request Sense.) use specified cleaning cassette (model name: SDX4-CL)

4.6.1.2. The condition of Cleaning Request

(1) Read/Write performance decreased.

(2) Every 100 hours of operation.

Note: (2) is enable when Periodic Cleaning Req Dip-SW is on. (Refer to 3.1)

4.6.1.3. Usage of Cleaning Cassette

(3) Drive displays cleaning cassette requirement.

(4) When specified cleaning cassette is inserted, automatic cleaning operation starts and when it's over, the cassette is ejected.

(5) One cleaning cassette can be used approximately 50 times in average.

(6) When the cleaning cassette is not ejected without doing cleaning, it is possible that there were no more cleaning tape left. Since cleaning tape cannot be used twice, please insert new cleaning cassette in this case.

(7) SDX4-CL can be inserted in other drives or consumer 8 mm drives, but you cannot expect good effect.

(8) The drive will not eject cleaning cassette for consumer drives or for any other format. "Cleaning is Not Completed" is indicated by the Cleaning Request LED.

4.6.2. Troubleshooting Guide

Problems encountered while operating the Sony SDX-900V tape drive fall into two categories: Operational problems and Read/Write problems.

Operational problems include any conditions that prevent the tape drive from operating. Operational problems usually are discovered the first time the drive is installed on a system or when the system configuration is changed or physically moved.

Read/Write problems include conditions that effect the transfer of data to and from the tape drive. Commands such as REWIND, REQUEST SENSE and UNLOAD perform normally but data transfers fail.

The following clauses describe the recommended procedures for solving operational and read/write problems.

4.6.2.1. Operational Problems

The tape drive will not accept a tape cartridge

Withdraw the tape cassette and turn the power to drive off, wait 5 seconds, then back on. Observe the drive for a normal power up sequence (see clause 4.3.4). If the LEDs do not light, check the power supply and power cable connection. If the drive completes the power on sequence normally but still won't accept the tape cassette, the drive may be defective.

A tape may already be in the drive. Tape LED is on. Press EJECT to remove the first tape. The power has been removed from the drive with a tape loaded. When the power is restored to the drive, it will detect the tape and rewind the tape to BOT. Press EJECT remove the cassette.

A tape is in the drive and will not eject.

If the SCSI command PREVENT ALLOW MEDIA REMOVAL (with Prevent bit set to one) has been sent to the drive, the cartridge will be retained in the drive even after an UNLOAD command. The EJECT button is also disabled. Send an PREVENT ALLOW MEDIA REMOVAL (with prevent bit clear) command, issue a SCSI bus reset, or power the drive off and back on to override this condition.

If Tape is still in the drive after following the above procedure. The drive has a serious problem and should be returned to Sony for repair with the tape in place.

Note: If it is absolutely mandatory that the tape cassette be removed prior to returning the drive for repair the following Emergency Cassette Removal procedure should be followed:

Caution: This procedure should only be attempted by a mechanically qualified person and will probably result in the tape being unusable. Do not proceed if further damage to the tape drive would be done.

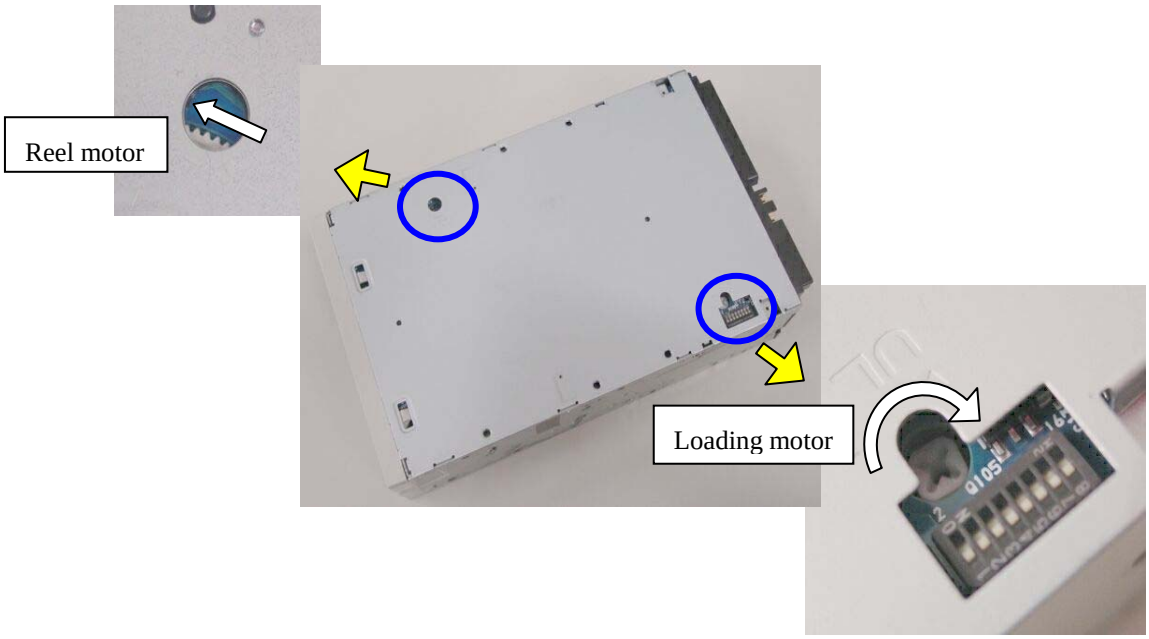


Photo 1: Emergency Tape Removal Procedure

Emergency Cassette Removal Procedure

1. Remove the drive from the chassis or enclosure to allow access to the bottom of the drive.
2. Remove the drive's top cover.
3. Locate the small opening in the bottom of the drive and insert the tip of a precision screwdriver so that the Loading motor shaft can be rotated.
4. Rotate the motor shaft clockwise to bring the threading mechanism back to the initial position.

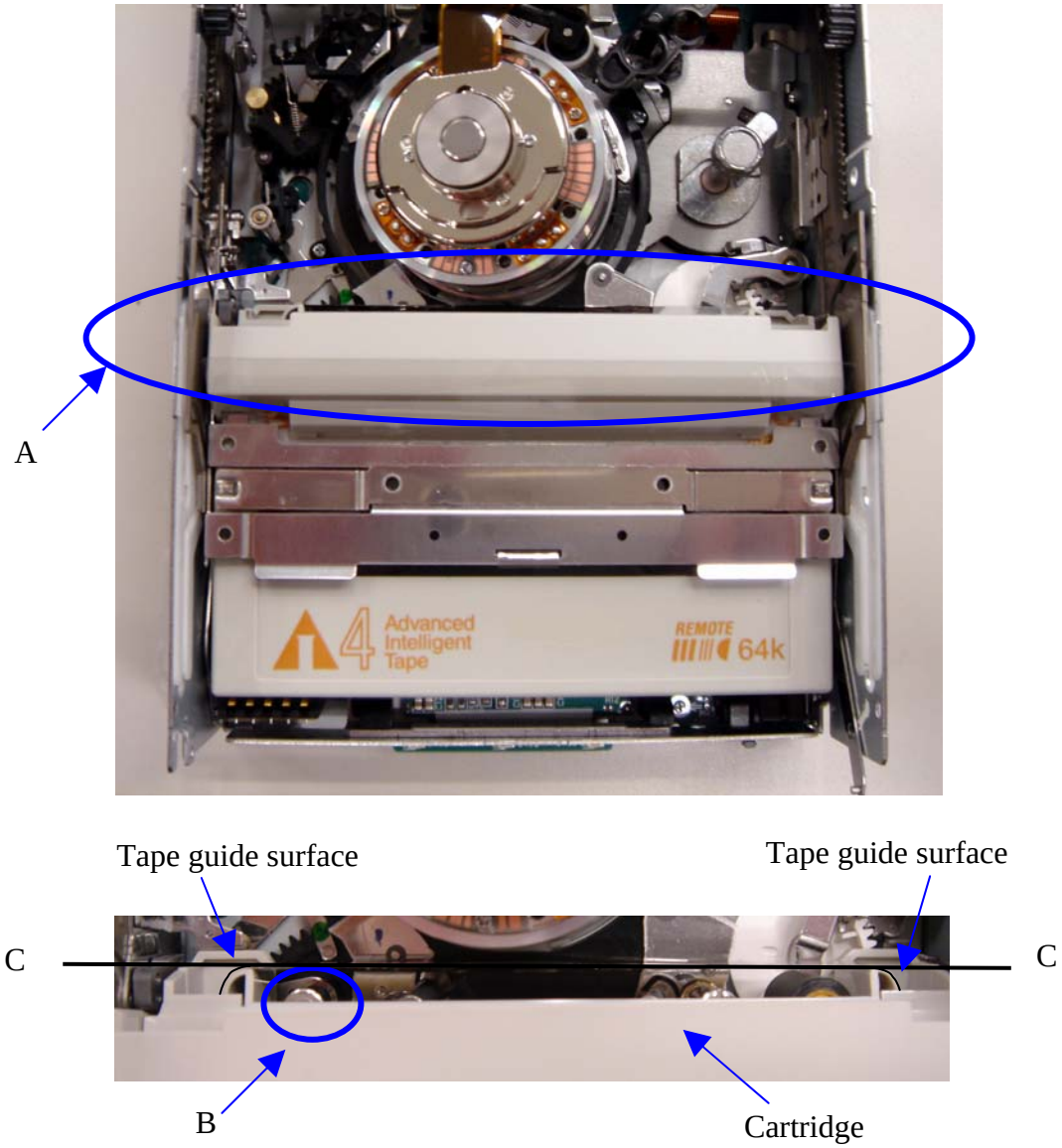


Photo 2: The Initial Position of the Threading Mechanism

Caution:
Stop rotating the motor shaft immediately, when the guide B (see detail A of Photo 2) gets to the area below the line C-C (This line is defined by 2 circular tape guide surfaces of the cartridge). Otherwise the gear of the drive can be damaged.

5. Before manual eject procedure, tape slack must be removed in order to prevent tape damage. Rotate the gear mechanism located on the bottom of the drive counterclockwise to tighten the tape.
6. After the tape slack has been removed, continue to turn the Loading moter shaft located on the bottom of the drive clockwise by a precision screwdriver until the tape cartridge is lifted out of the drive mechanism and is ejected.
7. Return the drive to Sony for repair.

The drive powers up properly and loads and unloads tapes but will not respond to any SCSI commands.

(A) If SCSI bus reset does not cause the drive to reset (same as power-on self test):

- Check the SCSI cable connectors
- Check SCSI cable pin one is aligned with the SCSI connector pin one
- Check for a broken cable or defective connector
- Try another known good SCSI device in the same location

(B) If SCSI bus reset causes the drive to reset then the problem is with the SCSI bus addressing or termination.

- Check that the SCSI bus ID jumper is set for the proper address (see clause 3.1.1)
- Check SCSI bus termination. The two SCSI devices at the ends of the bus should be terminated. No other units should have terminators installed

Note: The strength of the SCSI bus signals can be affected if too many terminators are installed (Signal drivers can be damaged as well)

4.6.2.2. Read/Write Problems

To prevent read/write errors, follow the cleaning recommendation in clause 4.6.1 If a read/write error occurs, a combination of the following steps should correct the problem.

- Remove the tape.
- Clean the drive with the AIT cleaning cartridge.
- Load a new tape in the drive.
- Retry the operation.

Note: If these steps do not correct the problem the drive may be defective and should be returned to Sony for service.

4.6.2.3. Replace Tape

When Media Error occur drive will indicate that tape is bad by turning on the Replace Tape LED. If this condition occurs, a combination of the following steps should correct the problem.

- Remove the tape.
- Clean the drive with the AIT cleaning cartridge.
- Load a new tape in the drive.
- Retry the operation.

Note: If these steps do not correct the problem the drive may be defective and should be returned to Sony for service.

4.6.2.4. Media Warning

When a Media Warning threshold is exceeded the drive will indicate that the tape is bad by flashing the Replace Tape LED MEW (Media Warning) bit is 1. The indicator will be on for 0.9 seconds, off for 0.3 seconds. The Tape Motion and Cleaning Request LEDs will operate normally. If this occurs, the data on the cassette should be copied onto a new one and the old cassette discarded. This status is cleared by unloading the cassette.

4.6.3. Clearance for Service

All servicing is performed only after removal of the SDX-900V from is mounting. It is recommended that in mounting the drive into a chassis provisions should be made to allow easy access to the mounting screws (see Figure 2-2).

4.6.4. Packaging for Return to Sony

The drive should be returned in its original packaging. Sony will not take responsibility for shipping damage caused to an improperly packaged drive.

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5. SCSI Interface

5.1. Introduction

The Sony SDX-900V uses the SCSI interface to connect to the host system. The Small Computer System Interface (SCSI) is an industry standard interface, approved by the American National Standards Institute (ANSI). It is recommended that this document be used along with the ANSI standard document. The ANSI specification defines the interface in general while this document describes the specific implementation for this unit. The SCSI documents, listed in detail in clause 1.2, offer the information required to integrate this unit with SCSI-compatible computer systems. This clause includes four sub-clauses:

- Introduction
- SCSI Bus Operation
- SCSI Messages
- SCSI Status

Note: The details of each SCSI Command are covered in Section 6.

The Introduction provides general, high-level information. For the hardware description and the installation requirements, see Section 2.The SCSI protocol supported by the unit are covered in the Bus Operation, Message, and Status clauses.

5.1.1. Overview of the SCSI Interface

The SCSI implementation provides the unit with a standard set of features and functions. These include:

- Asynchronous and Synchronous communication modes
- Single-ended / Differential Configurations
- Full implementation of Mandatory commands
- Implementation of most sequential non-Mandatory commands
- Ultra160 SCSI Interface
    i. Cyclic Redundancy Check (CRC)
    ii. Double Transition Clocking (DT)
    iii. Domain Validation

5.1.2. Supported Messages

The following messages are supported: (alphabetic order)

* Abort
* Bus Device Reset
* Command Complete
* Disconnect
* Extended Message - Synchronous Data Transfer Request
* Extended Message - Wide Data Transfer Request
* Extended Message - Parallel Protocol Request
* Identify (w/ & w/o disconnect)
* Ignore Wide Residue
* Initiator Detected Error
* Message Parity Error
* Message Reject
* No Operation
* Restore Pointers
* Save Data Pointer

For implementation details on these messages, see clause 5.3.

5.1.3. Supported Commands

The following commands are supported. They include all Mandatory and Extended commands, most Optional commands.

Table 5-1: Supported SCSI Commands

Command Name	Operation Code
ERASE	19h
INQUIRY	12h
LOAD/UNLOAD	1Bh
LOCATE	2Bh
LOG SELECT	4Ch
LOG SENSE	4Dh
MODE SELECT (6)	15h
MODE SELECT (10)	55h
MODE SENSE (6)	1Ah
MODE SENSE (10)	5Ah
PERSISTENT RESERVE IN	5Eh
PERSISTENT RESERVE OUT	5Fh
PREVENT ALLOW MEDIUM REMOVAL	1Eh
READ	08h
READ ATTRIBUTE	8Ch
READ BLOCK LIMITS	05h
READ BUFFER	3Ch
READ POSITION	34h
RECEIVE DIAGNOSTIC RESULTS	1Ch
RELEASE (6)	17h
RELEASE (10)	57h
REPORT DENSITY SUPPORT	44h
REPORT DEVICE IDENTIFIER	A3h
REPORT LUNS	A0h
REQUEST SENSE	03h
RESERVE (10)	16h
RESERVE (10)	56h
REWIND	01h
SEND DIAGNOSTIC	1Dh
SET DEVICE IDENTIFIER	A4h
SPACE	11h
TEST UNIT READY	00h
WRITE	0Ah
WRITE ATTRIBUTE	8Dh
WRITE BUFFER	3Bh
WRITE FILEMARKS	10h

5.2. SCSI Bus Operation

5.2.1. Typical SCSI Operation

This example describes the typical SCSI bus sequence between the host and the drive.

1. After waiting for the bus clear time the Host arbitrates for the SCSI bus. It does this by asserting BSY and the data line corresponding to its bus ID. If any other devices wish to compete for the bus, they also assert BSY and the appropriate data line. Each arbitrating device then inspects the data bus. The device with the highest ID wins the bus. All the other devices must release BSY and their data lines.
2. The Host attempts to select the target by asserting SEL and releasing BSY. The Host maintains its ID and asserts the target's ID on the data bus. Each target then checks the data lines. If the target's ID matches that on the data bus, it accepts selection by asserting BSY. Once the Host has detected BSY being asserted, it asserts ATN to indicate that it wants the target to go to the MESSAGE OUT phase. The Host releases SEL.
3. The target now has control of the SCSI bus and it is the target which switches between phases. The target responds to the ATTENTION condition and initiates the MESSAGE OUT phase. The Host sends an IDENTIFY message which tells the target which logical unit the Host wishes to talk to. The fact that the target responds to the ATN indicates to the Host that the target can accommodate more than just a COMMAND COMPLETE message.
4. The target initiates the COMMAND phase and transfers the Command Descriptor Block from the Host. In the COMMAND phase, the target decodes the command and either executes the command (TEST UNIT READY) or sets itself up for a data transfer to the Host (READ, WRITE, and INQUIRY etc.). The target then either switches to the STATUS phase, if the command is complete, or if it is ready to transfer data, the DATA phase.
5. The data transfer length is set by the Host in the Command Descriptor Block. The target will remain in the DATA phase until all the data is transferred.
6. The target then initiates a STATUS phase and transfers one byte to the Host to indicate whether the target has successfully completed the command. If the target has detected an error, the next command that the Host is expected to send is REQUEST SENSE. This allows the target to return further status information to the Host.
7. The target completes the SCSI sequence by going to the MESSAGE IN phase and transferring a COMMAND COMPLETE message to the Host. The target then releases BSY allowing the bus to go to the BUS FREE state.

5.2.2. Disconnect

In order to improve bus usage and performance, the unit is capable of temporarily disconnecting from the bus, consequently allowing other initiator-target communications to take place. To do so, however, the Host needs to support Disconnect/ Re-select. The mechanism for performing the Disconnect/ Re-select procedure is implemented as follows:

1. The Host arbitrates for the SCSI bus and upon winning the bus it proceeds to select target device. Prior to releasing SEL and completing the selection phase, the Host asserts the ATN line. The Host then releases SEL and BSY to allow the target to assume control of the SCSI bus. By asserting ATN, the host indicates that the target should go to a MESSAGE OUT phase.
2. At this point, the target responds to the Host ATTENTION condition by initiating a MESSAGE OUT phase and receiving a message from the Host which tells it whether or not the Host allows Disconnects for the desired logical unit on the target.
3. If the Host does not send an Identify message, the target assumes that Disconnects are not permitted.

4. The I/O activity from this point is controlled entirely by the target. The target initiates the COMMAND phase and reads in the Command Descriptor Block (CDB) from the Host. If the Host has sent an Identify message with the Disconnect permission bit set, then the target will immediately disconnect from the bus after the entire CDB has been received.

5. The Disconnect process occurs when the target initiates a MESSAGE IN phase and sends a DISCONNECT message back to the Host. This message may be preceded by a SAVE DATA POINTERS message byte if the Disconnect is performed in the middle of the DATA phase. Following the MESSAGE IN phase, the target frees the bus by releasing the BSY.

6. The host now waits for the target to perform Re-selection. When ready, the target re-selects the Host and sends an Identify message via a MESSAGE IN phases, indicating the specific logical unit with which the subsequent communications are to take place. Usually, the target will proceed from the MESSAGE IN phase to either a DATA or a STATUS phase. If the Host had been previously told to SAVE DATA POINTERS, then the target's Identify message implies that the Host restores its data pointers upon re-selection; in other words, it is not necessary for the target to send a specific RESTORE DATA POINTERS to the Host in such context.

7. When doing a large data transfer, the target may choose to divide the entire transfer into several smaller transfers. This allows the target to free the SCSI bus whenever it needs to perform its own system tasks not immediately related to the actual data transfer over the SCSI bus. The target will not lock the bus into the DATA phase if it is not presently ready to efficiently execute the transfer. After the data transfer is completed, the target enters a STATUS phase and sends a single status byte to the Host. It then proceeds to a MESSAGE IN phase, during which the target sends a COMMAND COMPLETE message. Finally, the target frees the bus and the current command is considered completed.

8. The Host may change Disconnect permission at any time after the SELECTION phase by asserting ATN and sending an Identify message via a MESSAGE OUT phase. If the Host, however, performs this action during a DATA phase, it is possible that the target will not notice the change in Disconnect permission status until past the end of the current bus phase.

5.3. Message Specification

This clause includes all SCSI messages. Both supported and non-supported messages are listed. Elements of this clause come from clause 5, Logical Characteristics, of the SCSI standard. The message system allows communication between an initiator and a target for the purpose of physical path management. The table below lists the Messages supported by the SDX-900V.

The SDX-900V supports the Synchronous Data Transfer Request Extended Message, and the Wide Data Transfer Request Message.

Table 5-2: Message Descriptions

Code	Description	Direction	
		In	Out
00	COMMAND COMPLETE	*	
01	EXTENDED MESSAGE	*	*
02	SAVE DATA POINTER	*	
03	RESTORE POINTERS	*	
04	DISCONNECT	*	
05	INITIATOR DETECTED ERROR		
06	ABORT		*
07	MESSAGE REJECT		*
08	NO OP	*	*
09	MESSAGE PARITY ERROR		*
0C	BUS DEVICE RESET		*
23	IGNORE WIDE RESIDUE	*	
80-CO	IDENTIFY	*	*

5.3.1. COMMAND COMPLETE (00h)

This message is sent from a target to an initiator to indicate that the execution of a command or a series of linked commands has completed and valid status has been sent to the initiator. After successfully sending this message, the target goes to the BUS FREE phase by releasing BSY.

When received as a target, it will be handled as an illegal message, the unit will return MESSAGE REJECT and will enter the status phase reporting CHECK CONDITION with the sense key set to COMMAND ABORTED.

5.3.2. EXTENDED MESSAGE (01h)

5.3.2.1. PARALLEL PROTOCOL REQUEST (04h)

PARALLEL PROTOCOL REQUEST messages are used to negotiate a synchronous data transfer agreement, a wide data transfer agreement, and set the protocol options between two SCSI devices. Negotiations using this message shall only be initiated by initiators. A Parallel Protocol Request message has the following format:

PARALLEL PROTOCOL REQUEST

Bit Byte	7	6	5	4	3	2	1	0
0	EXTENDED MESSAGE (01h)							
1	EXTENDED MESSAGE LENGTH (06h)							
2	PARALLEL PROTOCOL REQUEST (04h)							
3	TRANSFER PERIOD FACTOR							
4	RESERVED							
5	REQ/ACK OFFSET							
6	TRANSFER WIDTH EXPONENT (m)							
7	RESERVED					QAS_REQ	DT_REQ	IU_REQ

TRANSFER PERIOD FACTOR FIELD

Code	Description
09h	Transfer period equals 12.5 ns (Fast-80 data is latched every 12.5 ns). This code is only valid if the protocol options field has a value selected that supports double transition data transfer (DT_REQ is one)
0Ah	Transfer period equals 25 ns (Fast-40 data is latched every 25 ns or 30.3 ns).
0Bh	Transfer period equals 30.3 ns (Fast-40 data is latched every 25 ns or 30.3 ns).
0Ch	Transfer period equals 50 ns (Fast-20).
0Dh-18h	Transfer period equals the period factor x 4 (Fast-20).
19h-31h	Transfer period equals the period factor x 4 (Fast-10).
32h-FFh	Transfer period equals the period factor x 4

For single transition (ST) synchronous data transfer the REQ/ACK OFFSET is the maximum number of REQ assertions allowed to be outstanding before a corresponding ACK assertion is received at the target. The size of a data transfer may be 1 or 2 bytes depending on the values in the transfer width exponent field.

For double transition (DT) synchronous data transfer the REQ/ACK OFFSET is the maximum number of REQ transitions allowed to be outstanding before a corresponding ACK transition is received at the target. The size of a data transfer shall be 2 bytes.

The TRANSFER WIDTH EXPONENT field defines the transfer width to be used during DATA IN phases, and DATA OUT phases. The transfer width that is established applies to both SCSI devices. Valid transfer widths are 8 bits (m=00h) and 16 bits (m=01h) if all the protocol options bits are zero. The only valid transfer width is 16 bits (m=01h) if any of the protocol options bits are one.

QAS_REQ bit is not supported and shall be set to zero.

IU_REQ bit is not supported and shall be set to zero.

DT_REQ bit of zero indicates that DT DATA phases are to be disabled when received from the initiator and that DT DATA phases are disabled when received from the target. A DT_REQ bit of one indicates that DT DATA phases are to be enabled when received from the initiator and that DT DATA phases are enabled when received from the target.

A data transfer agreement only applies to the two SCSI devices that negotiate the agreement. Separate data transfer agreements are negotiated for each pair of SCSI devices. The data transfer agreement only applies to DATA phases.

A PARALLEL PROTOCOL REQUEST message exchange shall be initiated by an initiator whenever a previously arranged parallel protocol agreement may have become invalid. The agreement becomes invalid after any condition that may leave the parallel protocol agreement in an indeterminate state such as:

a) After a hard reset
b) After a TARGET RESET message
c) After a power cycle
d) After a change in the transceiver mode (e.g., LVD mode to SE mode)

5.3.2.2. SYNCHRONOUS DATA TRANSFER REQUEST (01h)

This is sent by either the initiator or the target as the first byte of a multiple-byte message. When acting as an initiator, the unit will not send any Extended Messages. No Vendor Unique codes are implemented and only the Synchronous Data Transfer Request code is supported. Any other message code is handled as an illegal message; the unit will return MESSAGE REJECT and will continue. A Synchronous Data Transfer Request message has the following format:

Table 5-3: Synchronous Data Transfer Request

Byte	Value	Description
0	01h	Extended message
1	03h	Extended message length
2	01h	SYNCHRONOUS DATA TRANSFER REQUEST code
3	M	Transfer period (m times 4 nanoseconds)
4	X	REQ/ACK offset

A SYNCHRONOUS DATA TRANSFER REQUEST (SDTR) message exchange shall be initiated by a SCSI device whenever a previously-arranged data transfer agreement may have become invalid. The agreement becomes invalid after any condition which may leave the data transfer agreement in an indeterminate state such as:

(1) after a hard reset condition
(2) after a BUS DEVICE RESET message and
(3) after a power cycle.

In addition, a SCSI device may initiate an SDTR message exchange whenever it is appropriate to negotiate a new data transfer agreement (either synchronous or asynchronous). SCSI devices that are capable of synchronous data transfers shall not respond to an SDTR message with a MESSAGE REJECT message.

The SDTR message exchange establishes the permissible transfer periods and the REQ/ACK offsets for all logical units and target routines on the two devices. This agreement only applies to data phases. The transfer period factor times four is the value of the transfer period.

Transfer period is the minimum time allowed between leading edges of successive REQ pulses and of successive ACK pulses. The SDX-900V supports the following transfer periods:

Table 5-4: Synchronous Data Transfer Rates

Transfer Period (hex)	9	0A	0C	19	1F	26	2C	32	38
Transfer Rate (MB/s) - narrow	80	40.0	20.0	10.0	8.0	6.67	5.71	5.00	4.44
Transfer Rate (MB/s)- wide	160	80.0	40.0	20.0	16.0	13.34	11.42	10.00	8.88

REQ/ACK offset: is the maximum number of REQ pulses allowed to be outstanding before the leading edge of its corresponding ACK pulse is received at the target. A REQ/ACK offset value of ZERO shall indicate asynchronous data transfer mode. The SDX-900V supports synchronous data transfer REQ/ACK offset values from 1 to 127.

The originating device (the device that sends the first of the pair of SDTR messages) sets its values according to the rules above to permit it to receive data successfully. If the responding device can also receive data successfully with these values (or smaller transfer periods or larger REQ/ACK offsets or both), it returns the same values in its SDTR message. If it requires a larger transfer period, a smaller REQ/ACK offset, or both in order to receive data successfully, it substitutes values in its SDTR message as required, returning unchanged any value not required to be changed. Each device when transmitting data shall respect the limits set by the other's SDTR message, but it is permitted to transfer data with larger transfer periods, smaller REQ/ACK offsets, or both than specified in the other's SDTR message. The successful completion of an exchange of SDTR messages implies an agreement as follows:

Responding Device SDTR response	Implied Agreement
(1) Non-ZERO REQ/ACK offset	Each device transmits data with a transfer period equal to or greater than and a REQ/ACK offset equal to or less than the values received in the other device's SDTR message.
(2) REQ/ACK offset equal to ZERO	Asynchronous transfer
(3) MESSAGE REJECT message	Asynchronous transfer

If the initiator recognizes that negotiation is required, it asserts the ATN signal and sends a SDTR message to begin the negotiating process. After successfully completing the MESSAGE OUT phase, the target shall respond with the proper SDTR message. If an abnormal condition prevents the target from returning an appropriate response, both devices shall go to asynchronous data transfer mode for data transfers between the two devices.

Following target response (1) above, the implied agreement for synchronous operation shall be considered to be negated by both the initiator and the target if the initiator asserts the ATN signal and the first message out is either MESSAGE PARITY ERROR or MESSAGE REJECT. In this case, both devices shall go to asynchronous data transfer mode for data transfers between the tow devices. For the MESSAGE PARITY ERROR case, the implied agreement shall be reinstated if a re-transmittal of the second of the pair of messages is successfully accomplished. After two retry attempts, if the target receives a MESSAGE PARITY ERROR message, it shall terminate the retry activity. This may be done either by changing to any other information transfer phase and transferring at least one byte of information or by going to the BUS FREE phase. The initiator shall accept such action as aborting the negotiation, and both devices shall go to asynchronous data transfer mode for data transfer between the two devices.

If the target recognizes that negotiation is required, it sends an SDTR message to the initiator. Prior to releasing the ACK signal on the last byte of the SDTR message from the target, the initiator shall assert the ATN signal and respond with its SDTR message or with a MESSAGE REJECT message. If an abnormal condition prevents the initiator from returning an appropriate response, both devices shall go to asynchronous data transfer mode for data transfers between the two devices.

Following an initiator's responding SDTR message, an implied agreement for synchronous operation shall not be considered to exist until the target leaves the MESSAGE OUT phase, indicating that the target has accepted the negotiation. After two retry attempts, if the target has not received the initiator's responding SDTR message, it shall go to the BUS FREE phase without any further information transfer attempt. This indicates that a catastrophic error condition has occurred. Both devices shall go to asynchronous data transfer mode for data transfer between the two devices.

If, following an initiator's responding SDTR message, the target shifts to MESSAGE IN phase and the first message in is MESSAGE REJECT, the implied agreement shall be considered to be negated and both devices shall go to asynchronous data transfer mode for data transfers between the two devices.

The implied synchronous agreement shall remain in effect until a BUS DEVICE RESET message is received, until a hard reset condition occurs, or until one of the two SCSI devices elects to modify the agreement. The default data transfer mode is asynchronous data transfer mode. The default data transfer mode is entered at power on, after a BUS DEVICE RESET message, or after a hard reset condition.

5.3.2.3. WIDE DATA TRANSFER REQUEST

Byte	Value	
0	01	Extended message
1	02	Extended message length
2	03	WIDE DATA TRANSFER REQUEST code
3	m	Transfer Width exponent

A WIDE DATA TRANSFER REQUEST (WDTR) message exchange shall be initiated by a SCSI device whenever a previously-arranged transfer width agreement may have become invalid. The agreement becomes invalid after any condition which may leave the data transfer agreement in an indeterminate state such as:

(1) after a hard reset condition;
(2) after a BUS DEVICE RESET message and;
(3) after a power cycle.

In addition, a SCSI device may initiate a WDTR message exchange whenever it is appropriate to negotiate a new transfer width agreement. SCSI devices that are capable of wide data transfers (greater than eight bits) shall not respond to a WDTR with a MESSAGE REJECT message.

The WDTR message exchange establishes an agreement between two SCSI devices on the width of the data path to be used for DATA phase transfers between the two devices. This agreement applies to DATA IN and DATA OUT phases only. All other information transfer phases shall use an eight-bit data path.

If a SCSI device implements both wide data transfer option and synchronous data transfer option, then it shall negotiate the wide data transfer agreement prior to negotiating the synchronous data transfer agreement. If a synchronous data transfer agreement is in effect, then a SCSI device that accepts a WDTR message shall reset the synchronous agreement to asynchronous mode.

The transfer width is two to the transfer width exponent bytes wide. The transfer width that is established applies to logical units on both SCSI devices. Valid transfer widths are 8 bits (m=00h), and 16 bits (m=01h). Values of m=02 and greater are reserved.

The originating SCSI device (the SCSI device that sends the first of the pair of WDTR messages) sets its transfer width value to maximum data path width it elects to accommodate. If the responding SCSI device can also accommodate this transfer width, it returns the same value in its WDTR message. If it requires a smaller transfer width, it substitutes the smaller value in its WDTR message. The successful completion of an exchange of WDTR messages implies an agreement as follows:

Responding device WDTR response	Implied agreement
a) Non-ZERO transfer width	Each device transmits and receives data with a transfer width equal to the responding SCSI device's transfer width.
b) Transfer width equal to ZERO	Eight -bit data transfer
c) MESSAGE REJECT message	Eight -bit data transfer

If the initiator recognizes that negotiation is required, it asserts the ATN signal and sends a WDTR message to begin the negotiating process. After successfully completing the MESSAGE OUT phase, the target shall respond with the proper WDTR message. If an abnormal condition prevents the target from returning an appropriate response, both devices shall go to eight-bit data transfer mode for data transfers between the two devices.

Following target response (1) above, the implied agreement for wide data transfers shall be considered to be negated by both the initiator and the target if it the initiator asserts ATN and the first message out is either MESSAGE PARITY ERROR or MESSAGE REJECT. In this case, both devices shall go to eight-bit data transfer mode for data transfers between the two devices. For the MESSAGE PARITY ERROR case, the implied agreement shall be reinstated if a re-transmittal of the second of the pair of messages is successfully accomplished. After a vendor-specific number of retry attempts (greater than ZERO), if the target receives a MESSAGE PARITY ERROR message, it shall terminate the retry activity. This may be done either by changing to any other information transfer phase and transferring at least on byte of information or by going to the BUS FREE phase. The initiator shall accept such action as aborting the negotiation and both devices shall go to eight -bit data transfer mode for data transfers between the two devices.

The implied transfer width agreement shall remain in effect until a BUS DEVICE RESET message is received, until a hard reset condition occurs, or until one of the two SCSI devices elects to modify the agreement. The default data transfer width is eight-bit data transfer mode. The default data transfer mode is entered at power on m, after a BUS DEVICE RESET message, or after a hard reset condition.

5.3.3. SAVE DATA POINTER (02h)

This message is sent from a target to the initiator at the end of a Data Phase to request that the initiator save a copy of the present active data pointer for the currently attached logical unit. The unit will accept this message when in the initiator mode. As a target, it will send this message prior to a disconnect. When received as a target, it will be handled as an illegal message, the unit will return MESSAGE REJECT and will enter the status phase reporting CHECK CONDITION with the sense key set to COMMAND ABORTED.

5.3.4. RESTORE POINTERS (03h)

This message is sent from a target to direct the initiator to restore the most recently saved pointers for the currently attached logical unit to the active state. Pointers to the command, data, and status locations for the logical unit will be restored to the active pointers. Command and status pointers will be restored to the beginning of the present command and status areas. The data pointer will be restored to the value at the beginning of the data area in the absence of a SAVE DATA POINTER message or to the value at the point at which the last SAVE DATA POINTER message occurred for that logical unit.

The unit sends a RESTORE POINTERS message. Rather, it relies on the implicit restore pointers inherent in a re-selection.

When acting as initiator, the unit will accept a RESTORE POINTERS message before resending a previously unsuccessful status or data transfer. It doesn't send a RESTORE POINTERS for re-selection but relies on the implicit restore pointers in re-selection.

When received as a target, it will be handled as an illegal message; the unit will return MESSAGE REJECT and will continue.

5.3.5. DISCONNECT (04h)

This message is sent from a target to inform an initiator that the present physical path is going to be broken (the target plans to disconnect by releasing BSY). Later, reelection will be required in order to complete the current operation.

Note: The initiator detects a catastrophic error condition when the BUS FREE phase occurs (other than as result of a RESET condition) without first receiving a DISCONNECT or COMMAND COMPLETE message. If the target intentionally creates this condition, the target clears the current command. This message does not cause the initiator to save the data pointer.

The unit will support this message as an initiator. As a target, the unit supports this message and will disconnect if allowed by the initiator.

When received as a target, it will be handled as an illegal message; the unit will return MESSAGE REJECT and will continue.

5.3.6. INITIATOR DETECTED ERROR (05h)

This message is sent from an initiator to inform a target that an error (e.g.: parity error) has occurred that does not prevent the target from re-trying the operation. At this point, present pointer integrity is not assured. A RESTORE POINTERS message or a disconnect followed by a re-selection, will cause the pointers to be restored to their previously defined state.

This message will not be sent by the drive, when the drive is acting as an initiator. When received as a target the unit will enter the status phase reporting CHECK CONDITION with the sense key set to COMMAND ABORTED.

5.3.7. ABORT (06h)

This message is sent from the initiator to the target to clear the present operation. All pending data and status from the affected logical unit is cleared, and the target goes to the BUS FREE phase. This message can be sent to a logical unit that is not currently performing an operation for the initiator.

A transaction which has not yet been acknowledged with a good Status byte will cause the transaction to be aborted. If a transaction has already been acknowledged, the abort will force a Write of any pending data. The device will proceed directly to BUS FREE state.

5.3.8. MESSAGE REJECT (07h)

This message is sent from either the initiator or target to indicate that the last message it received was inappropriate or has not been implemented.

In order to indicate its intentions of sending this message, the initiator asserts the ATN signal prior to its release of ACK for the REQ ACK handshake of the message that is to be rejected. Message Reject is issued in response to any messages which the unit considers to be illegal or not supported. The illegal message will cause the current command to be aborted and the unit will enter the status phase reporting CHECK CONDITION with the sense key set to COMMAND ABORTED.

When received as a target, if the unit was previously in Message In phase (i.e.: sending messages to the host) then MESSAGE REJECT will cause the unit to go straight to the Status phase with a CHECK CONDITION status and a sense key of COMMAND ABORTED. If the unit was not previously in Message In phase then MESSAGE REJECT will be handled as an illegal message.

If the initiator sends MESSAGE REJECT message in response to the units DISCONNECT message, the unit will disable disconnects for the rest of the nexus and continue.

5.3.9. NO OPERATION (08h)

This message is sent by an initiator in response to a target's request for a message when the initiator does not currently have any other valid message to send. This message is accepted when the drive is acting as a target, and may be sent when it is an initiator. When a NO-OP is received during any phase, the unit will continue as though nothing had happened.

5.3.10. MESSAGE PARITY ERROR (09h)

This message is sent from the initiator to the target to indicate that one or more bytes in the last message it received had a parity error.

To indicate its intentions of sending this message, the initiator will send the ATN signal prior to its release of ACK for the REQ/ACK handshake of the message that has the parity error. This provides an interlock so that the target can determine which message has the parity error.

This message will not be sent by the drive, when the drive is acting as an initiator. When received as a target, the unit will enter the Status phase reporting CHECK CONDITION with the sense key set to COMMAND ABORTED.

5.3.11. BUS DEVICE RESET (0Ch)

This message is sent from an initiator to direct a target to clear all current commands. Upon recognizing this message, the currently executing command will be aborted and the drive will proceed to the BUS FREE state. The drive will then execute a hard reset which will leave the drive in a state as if it had been power-cycled. All data in the buffer will be written to tape before the reset is performed.

A BUS DEVICE RESET message should be used to reset the drive, rather than a hard reset, as this will only reset the drive rather than all the devices on the bus.

Due to the catastrophic nature of this command, it should be used cautiously in a multiple initiator system.

5.3.12. IDENTIFY (80h-FFh)

These messages are sent by either the initiator or the target to establish the physical connection path between an initiator and target for a particular logical unit. This message byte can have the following bits set:

Bit 7 This bit is always set to one to distinguish these messages from other messages.

Bit 6 This bit is only set to one by the initiator. When set to one, it indicates that the initiator has the ability to disconnect and reconnect.

Bit 5 LUNTAR: This bit is always ZERO to indicate that the LUNTRN field below is valid.

Bits 4-3 Reserved.

Bits 2-0 LUNTRN: These bits specify a logical unit number in a target, and must always be set to ZERO as the unit is a single target, single logical unit device on the SCSI bus. The Logical Unit Number for the drive is fixed and is set to ZERO. Any other value will cause the unit to enter the status phase reporting CHECK CONDITION with the sense key set to COMMAND ABORTED.

Therefore, only the values 80h and C0h are supported.

When sent from a target to an initiator during reconnection, an implied RESTORE POINTERS message will be performed by the initiator prior to completion of this message, since at no time will a RESTORE POINTERS be sent.

5.3.13. IGNORE WIDE RESIDUE (23h)

Table 5-5: Ignore Wide Residue Message

Byte	Value	
0	23	Message Code
1	01	Ignore

The IGNORE WIDE RESIDUE message (see table 5-5) shall be sent from the SDX-900V to indicate that the number of valid bytes sent during the last REQ/ACK handshake and REQB/ACKB handshake of a DATA IN phase is less than the negotiated transfer width. The ignore field indicates the number of invalid data bytes transferred. This message shall be sent immediately following that DATA IN phase and prior to any other messages. The ignore field is defined in table 5-6. More than one IGNORE WIDE RESIDUE message may occur during an I/O process.

Table 5-6: Ignore Field

Ignore	Invalid data bits
	16-bit transfers
00h	Reserved
01h	DB (15-8)
02-FFh	Reserved

Even though a byte is invalid its corresponding parity bit shall be valid for the value transferred.

5.4. Status Specification

A Status byte is sent from the drive to the Host during the STATUS phase at the termination of each command as specified in the SCSI specification, unless the command has been cleared by an ABORT message, by a BUS DEVICE RESET message, or by a hard RESET.

The Status bytes that will be return are:

00h GOOD: This status indicates that the drive has successfully completed the command.

02h CHECK CONDITION: Any error, exception, or abnormal condition that causes sense data to be set returns CHECK CONDITION. The REQUEST SENSE command should be sent following this status to determine the nature of the error.

08h BUSY: The drive is busy. This status is returned whenever the drive is unable to accept a command from an otherwise acceptable initiator. The BUSY status will be returned by the unit, if, while it is DISCONNECTED from the SCSI bus, it receives a command from a different initiator. The unit does not stack commands and therefore will not accept the next command until the current one has completed. Note that if an initiator sends overlapped commands to the unit (i.e.: it sends a new command while the previous one is still executing and the unit is disconnected) then the first command will be aborted and a CHECK CONDITION will be returned to the initiator to indicate that the command was aborted. The second command will NOT be executed.

The BUSY status returned by the drive must not be confused with DRIVE NOT READY. DRIVE NOT READY will be returned as part of the Sense data following a REQUEST SENSE command and indicates that the drive is off-line and no media is loaded in the drive.

The drive is deemed off-line if the tape is currently unloaded and, normally, ejected from the drive. However, the drive will still be off-line if the tape has been retained within the drive following a Host issued PREVENT MEDIA REMOVAL command prior to the unload.

In the off-line state, the Host cannot perform any operation which would cause tape motion. These commands will return a CHECK CONDITION status with a DRIVE NOT READY sense key set. The command types which are not allowed are write, read, verify or space commands. The Host may load the tape when the unit is off-line so long as the tape has been prevented from being ejected via the PREVENT/ALLOW MEDIA REMOVAL command.

While the drive is “Busy” the Host may issue any command, including diagnostic commands, which do not access the tape and a GOOD status shall be returned. These commands are:

INQUIRY
LOG SELECT
LOG SENSE
MODE SELECT
MODE SENSE
PREVENT ALLOW MEDIUM REMOVAL
READ BLOCK LIMITS
READ BUFFER
RECEIVE DIAGNOSTIC RESULTS
RELEASE UNIT
REQUEST SENSE
RESERVE UNIT
SEND DIAGNOSTIC
WRITE BUFFER

The TEST UNIT READY command is used to determine the on-line/off-line state of the drive and will, therefore, return a CHECK CONDITION status with a DRIVE NOT READY sense key set if no media is currently loaded.

10h INTERMEDIATE GOOD: This status is returned for every command in a series of linked commands (except the last command), unless an error, exception or abnormal condition causes a CHECK CONDITION status or RESERVATION CONFLICT status to be set. If this status is not returned, the chain of linked commands is broken; no further commands in the series are executed.

18h RESERVATION CONFLICT: This status is returned by the drive whenever the host or another SCSI device attempts to access the drive if it has been reserved via the RESERVE UNIT command.

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6. Command Specification

This clause includes all supported. Elements of this clause come from clauses 7, 8 and 9 of the T10/1236-D (SPC-2), T10/1416-D (SPC-3), ANSI NCITS.335:2000 (SSC), SCSI interface specification.
There are different types of SCSI commands, each with a specific, required length (in bytes.) The majority of the commands are 6 byte Group 0 commands. Group 1 & 2 commands are 10 bytes long. Note that the drive will wait until the required number of bytes are transferred. At the termination of each command, the target sends a status byte to the initiator. See the clause on Status for more details. The following is a list of the supported SCSI Commands and page index:

Table 6-1: SCSI Commands and Page Index

PARA	SCSI COMMAND	OP CODE	PAGE
6.1	ERASE	19h	6-2
6.2	INQUIRY	12h	6-3
6.3	LOAD /UNLOAD	1Bh	6-8
6.4	LOCATE	2Bh	6-10
6.5	LOG SELECT	4Ch	6-11
6.6	LOG SENSE	4Dh	6-13
6.7	MODE SELECT (6)	15h	6-38
6.7	MODE SELECT (10)	55h	6-38
6.8	MODE SENSE (6)	1Ah	6-56
6.8	MODE SENSE (10)	5Ah	6-56
6.9	PERSISTENT RESERVE IN	5Eh	6-59
6.10	PERSISTENT RESERVE OUT	5Fh	6-62
6.11	PREVENT ALLOW MEDIUM REMOVAL	1Eh	6-64
6.12	READ	08h	6-65
6.13	READ ATTRIBUTE	8Ch	6-67
6.14	READ BLOCK LIMITS	05h	6-71
6.15	READ BUFFER	3Ch	6-72
6.16	READ POSITION	34h	6-75
6.17	RECEIVE DIAGNOSTIC RESULTS	1Ch	6-77
6.18	RELEASE (6)	17h	6-79
6.18	RELEASE (10)	57h	6-79
6.19	REPORT DENSITY SUPPORT	44h	6-81
6.20	REPORT DEVICE IDENTIFIER	A3h	6-84
6.21	REPORT LUNS	A0h	6-85
	REQUEST BLOCK ADDRESS (obsolete)		
6.22	REQUEST SENSE	03h	6-86
6.23	RESERVE (10)	16h	6-94
6.23	RESERVE (10)	56h	6-94
6.24	REWIND	01h	6-96
	SEEK BLOCK (obsolete)		
6.25	SEND DIAGNOSTIC	1Dh	6-97
6.26	SET DEVICE IDENTIFIER	A4h	6-99
6.27	SPACE	11h	6-100
6.28	TEST UNIT READY	00h	6-103
	VERIFY (obsolete)		
6.29	WRITE	0Ah	6-104
6.30	WRITE ATTRIBUTE	8Dh	6-105
6.31	WRITE BUFFER	3Bh	6-107
6.32	WRITE FILEMARKS	10h	6-109

Note: In compliance with the SCSI specification, the unit will terminate the command with a CHECK CONDITION status and the sense key will be set to ILLEGAL REQUEST when a reserved bit, byte, field or code is not ZERO.
The unit has an embedded SCSI controller interface and therefore is a single target, single logical unit device when on the SCSI bus. The Obsolete for the drive is fixed and is set to ZERO. In order to be SCSI-2 or SCSI-3 compatible, the following scheme is used to check the LUN:

SCSI-2 states that the LUN addressed by the host should appear in the IDENTIFY message sent to the target on selection. LUN field inside of CDB is should be “obsolete”.

6.1. ERASE 19h

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (19h)							
1	Obsolete			Reserved			Immed	Long
2	Reserved							
3	Reserved							
4	Reserved							
5	Control							

ERASE causes part or all of the remaining data within a partition to be erased beginning at the current logical position. Any write data that is currently held in the buffer is written to tape before the ERASE is executed.

Immed: If the Immed bit is set to ZERO, the drive will not return status until the selected operation has completed. If the bit is set, status will be returned as soon as the operation has been initiated.

Long: If the Long bit is set to ONE, it should be written from the current logical position until EOM/EOP. If the Long bit is set to ZERO, EOD should be written to the current logical position.

6.2. INQUIRY 12h

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (12h)							
1	Obsolete			Reserved			CmdDT	EVPD
2	Page or Operation Code							
3	Reserved							
4	Allocation Length							
5	Control							

INQUIRY tells the drive to send information regarding the drive parameters to the initiator.

CmdDT: The Command support data (CmdDT) bit of one specifies that the drive returns the optional support data specified by the operation code field.

EVPD: The Enable Vital Product Data (EVPD) bit of one specifies that the drive returns the optional vital product data specified by the page code field.

If both the CmdDT and EVPD bits are zero, the drive returns the standard INQUIRY data. If the page or operation code field is not zero when both CmdDT and EVPD are zero, the drive returns a CHECK CONDITION status with an ILLEGAL REQUEST Sense Key.

If the CmdDT and EVPD bits are one, the drive returns a CHECK CONDITION status with an ILLEGAL REQUEST Sense Key.

When the EVPD bit is set to one, the drive returns vital product data that is specified in the page or operation code field. If the page or operation code field is reserved or not implemented by the target, the target shall terminate the command with a CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST.

When the CmdDT bit is set to one, the page or operation field specifies the SCSI operation code for which the drive shall return support data.

Allocation Length: This specifies the maximum number of bytes that the initiator has allocated for returned Inquiry data. An Allocation Length of ZERO indicates that no Inquiry data is transferred. This condition is not considered an error. The drive will terminate the DATA IN phase when Allocation Length bytes have been transferred or when all available Inquiry data have been transferred to the initiator, whichever is less.

Table 6-2: Standard INQUIRY Data

Bit / Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type (01h)				
1	RMB(1)	Device-Type Modifier (0)						
2	ISO Version (0)		ECMA Version (0)			ANSI-Approved Version (3)		
3	AENC (0)	TrmIOP	Reserved(0)		Response Data Format (2)			
4	Additional Length (34h)							
5	Reserved							
6	Reserved							Addr16 (1)
7	RelAdr (0)	Reserved	WB16 (1)	Sync (1)	Linked (0)	Reserved	CmdQ (0)	SftRe (0)
8	(MSB)	Vendor Identification						
15		(SONY)						(LSB)
16	(MSB)	Product Identification						
31		(SDX-900V)						(LSB)
32	(MSB)	Product Revision Level						
35								(LSB)
36	Reserved							
42	Reserved							
43	Drive Mode							
49	(DR-10)							
50	Reserved							
55	Reserved							
56	Reserved				CLOCKING (11b)		QAS (0)	IUS (0)

Peripheral Qualifier and Peripheral Device Type: These fields identify the device that is currently connected to the logical unit. The drive is a single target, single logical unit device. The logical unit number is set to ZERO. Therefore, the drive normally returns Peripheral Qualifier set to 000b the specified peripheral device type is currently connected to this logical unit and Peripheral Device Type set to 01h sequential-access device .However, if the initiator requests a logical unit number greater than ZERO, the drive returns Peripheral Qualifier set to 011b the target is not capable of supporting a physical device on this logical unit and Peripheral Device Type set to 1Fh unknown device type .

RMB: The Removable Medium bit is one, indicating that the tape can be removed.

Device-Type Modifier: This is a seven-bit user defined code, set to 00h.

ISO Version: This field is ZERO, indicating that the drive does not necessarily comply with the ISO version of SCSI.

ECMA VERSION: This field is ZERO, indicating that the drive does not necessarily comply with the ECMA version of SCSI.

ANSI Approved Version: This field indicates the implemented version of the ANSI version.

AENC: The drive does not support asynchronous event notification, so this field is ZERO.

TrmIOP: The drive does not support the Terminate I/O Process message, so this field is ZERO.

Response Data Format: This field is 2 indicating that the INQUIRY DATA format complies with the ANSI version of SCSI-2.

Additional length: The additional length field specifies the length in bytes of the parameters, in this case, 31 bytes.

RelAdr: The drive does not support the Relative Addressing mode, so this bit is never set.

Wbus16: The drive supports 16-bit wide data transfers, so this bit is set.

Sync: The drive supports synchronous data transfers, so this bit is set.

Linked: The drive does not support linked command.

CmdQue: The drive does not support tagged command queuing , so this bit is never set.

SftRe: The drive responds to the RESET condition with a HARD reset , so this bit is never set.

Vendor Identification: This field contains eight bytes of ASCII data identifying the vendor of the product as " SONY".

This and the next two fields are left-aligned with the unused bytes at the end of the fields and filled with space characters (20h).

Product Identification: This field contains sixteen bytes of ASCII data identifying the product as "SDX-900V" for the data compression model.

Product Revision Level: This field contains four bytes of ASCII data, which define the SCSI Interface Revision Level.

Addr16: This bit set to 1 indicates the drive supports 16-bit wide SCSI addresses.

Clocking: This field set to 3 indicates the drive supports both ST (single transition) and DT (double transition).

QAS: The drive does not support quick arbitration.

IUS: The drive does not support information units.

Vital Product Data

This contains a list of the vital product data codes supported by the drive.

- Supported Vital Product Data pages

Bit / Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type (01h)				
1	Page Code (00h)							
2	Reserved (00h)							
3	Page Length (04h)							
4	Supported Page List (00h)							
5	Supported Page List (80h)							
6	Supported Page List (83h)							
7	Supported Page List (C0H)							

- Unit Serial Number page

Bit / Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type (01h)				
1	Page Code (80h)							
2	Reserved (00h)							
3	Page Length (0Ah)							
4	Product Serial number (in ASCII)							
13								

The page length field specifies the length of the product serial number. If the allocation length is too small to transfer all of the page, the page length shall not be adjusted to reflect the truncation.

The product serial number field contains ASCII data that is vendor-specific. The least significant ASCII character of the number shall appear as the last byte of a successful data transfer.

- Device Identification page

Bit / Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type (01h)				
1	Page Code (83h)							
2	Reserved (00h)							
3	Page Length (32h)							
4	Reserved (00h)				Code set (02h)			
5	Reserved (00h)				Identifier type (01h)			
6	Reserved (00h)							
7	Identifier length (22h)							
8	Vendor ID (SONY)							
15								
16	Product ID (SDX-900V)							
31								
32	Serial Number of the drive							
41								
42	Reserved (00h)				Code set (01h)			
43	Reserved (00h)				Identifier type (02h)			
44	Reserved (00h)							
45	Identifier length (08h)							
46	IEEE EUI-64 Code							
53								

IEEE EUI-64: The identifier field a Canonical form IEEE Extended Unique Identifier, 64-bit (EUI-64). (ANSI/IEEE 394:1995)

- Product Revision page

Bit / Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type (01h)				
1	Page Code (C0h)							
2	Reserved (00h)							
3	Page Length (08h)							
4	Product Revision Level							
7								
8	Reserved							
11								

Command support data

If the drive implements the requested SCSI operation code, it shall return the data defined in table 6-3. If the device does not implement the requested SCSI operation code it shall return the peripheral qualifier and type and 001b in the Support field.

Table 6-3: Command support Data

Bit / Byte	7	6	5	4	3	2	1	0
0	Peripheral Quaifier			Peripheral Device Type (01h)				
1	Reserved (00h)					Support		
2	ISO version (0)		ECMA version (0)		ANSI – Approved version (03h)			
3	Reserved (00h)							
4	Reserved (00h)							
5	CDB size (m-5)							
6	CDB usage data							
m								

Support: The drive supports the tested SCSI operation code in conformance with a SCSI standard. The data format conforms to the definition in table 6-3 .

6.3. LOAD/UNLOAD 1Bh

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Bh)							
1	Reserved							IMMED
2	Reserved							
3	Reserved							
4	Reserved				HOLD	EOT (0)	RETEN	LOAD
5	Control							

The LOAD UNLOAD command requests that the drive enable or disable the media for further operations. This command may also be used to request a retention function.

IMMED: If this bit is set, status is returned as soon as the load or unload operation is initiated. Otherwise, the status is returned after the operation has completed.

LOAD: A LOAD bit of one and a HOLD bit of zero indicates the medium in the drive shall be loaded and positioned to the beginning-of-partition zero. A LOAD bit of zero and a HOLD bit of zero indicates the medium in the drive shall be positioned for removal at the extreme position along the medium specified by the EOT bit.

A LOAD bit of one and a HOLD bit of one indicates if the medium has not been moved into the logical unit, the medium shall be moved in but not positioned for access. The EOT and RETEN bits shall be set to zero. Following successful completion, the drive shall return GOOD STATUS. If both the medium and drive support MAM, the drive shall generate a unit attention condition for all initiators with the additional sense code and additional sense code qualifier set to MEDIUM AUXILIARY MEMORY ACCESSIBLE.

A LOAD bit of zero and a HOLD bit of one indicates if the medium is in the drive, the medium shall be unthreaded but shall not be ejected. Following successful completion, the drive shall return GOOD STATUS. If both the medium and drive support MAM, the drive shall generate a unit attention condition for all initiators with the additional sense code and additional sense code qualifier set to MEDIUM AUXILIARY MEMORY ACCESSIBLE.

RETEN: A RETEN bit of one indicates that the drive unit shall perform a retention function on the current medium. A RETEN bit of zero indicates that the drive shall not perform a retention function on the current medium.

EOT: An end-of-tape (EOT) bit of one and a Load bit of ZERO indicates that the medium shall be positioned at end-of-medium for removal from the peripheral device. Prior to performing the unload operation, any buffered data that is to be written shall be transferred to the medium. An EOT bit of ZERO and Load bit of ZERO indicates that the medium shall positioned at beginning-of-medium for removal etc. This drive does not support this bit. EOT bit of one shall cause the target to return CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall be set to ILLEGAL FIELD IN CDB. This field is not supported. This field should be set to 0.

HOLD: A HOLD bit of one indicates MAM shall be accessible upon completion of the command but the medium shall not be positioned for access. A HOLD bit of zero and a LOAD bit of one indicates the medium shall be positioned for access. A HOLD bit of zero and a LOAD bit of zero indicates MAM shall not be accessible upon completion of the command.

If the drive has received an UNLOAD command with the Immediate bit set and then receives either another command which would involve tape motion or TEST UNIT READY, the drive will return a CHECK CONDITION status with a NOT READY sense key set.

When the drive receives the UNLOAD, the tape is rewound to BOM and ejected. The operator must reload the drive manually. If, however, the drive has previously received a PREVENT MEDIA REMOVAL (with prevent bit set) command, the tape is retained in the drive. A subsequent LOAD command will load and position the tape at BOP ZERO. If an UNLOAD was sent instead, the drive would return NOT READY and the tape would remain within the drive. In this case, the drive requires a PREVENT ALLOW MEDIA REMOVAL (with prevent bit clear) command before an UNLOAD will eject the tape.

Note: While the PREVENT MEDIA REMOVAL is in effect, the Front Panel EJECT button is completely disabled.

If the cassette is unloaded but has not been ejected from the drive because of moisture detection, then a subsequent UNLOAD will cause the tape to eject from the drive. All commands except INQUIRY, REQUEST SENSE and READ BLOCK LIMITS will return a CHECK CONDITION status with a HARDWARE ERROR sense key set. The tape may also be ejected via the Front Panel EJECT button.

If no cassette is in drive, both LOAD and UNLOAD will return a CHECK CONDITION status with NOT READY sense key set

The valid combinations of the last four fields are given in Table 6-4 below.

Table 6-4: LOAD UNLOAD Command Parameter Combinations

HOLD	RETEN	LOAD	ACTION
0	0	1 (Load)	Normal load to access the medium without a retention operation, positioned at BOP0. Logical Unit in READY state. Immed may be ZERO or 1b.
1	0	1 (Load)	Load to access MAM only. Logical Unit in NOT READY state. Immed may be ZERO or 1b. MAM Load Count is not incremented. Unit Attention Condition set for MEDIUM AUXILIARY MEMORY ACCESSIBLE.
0	1	1 (Load)	Normal load to access the medium after a retention operation, positioned at BOP0. Logical Unit in READY state. Immed may be ZERO or 1b.
1	1	1 (Load)	Invalid Combination. Command terminates with CHECK CONDITION Status. The sense key is set to ILLEGAL REQUEST and the additional sense code is set to INVALID FIELD IN CDB.
0	0	0 (Unload)	Normal Unload/Eject of cartridge. Logical Unit enter NOT READY state. Immed may be ZERO or 1b.
1	0	0 (Unload)	Unload of cartridge, but MAM still accessible but cartridge is not ejected. Logical Unit enters NOT READY state. Immed may be ZERO or 1b. Unit Attention Condition set for MEDIUM AUXILIARY MEMORY ACCESSIBLE.
0	1	0 (Unload)	Normal Unload/Eject of cartridge after a retention operation. Logical Unit enters NOT READY state. Immed may be ZERO or 1b.
1	1	0 (Unload)	Unload of cartridge after retention operation, but MAM still accessible. Logical Unit enter NOT READY state. Immed may be ZERO or 1b.

6.4. LOCATE 2Bh

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (2Bh)							
1	Obsolete			Reserved		BT (0)	CP	Immed
2	Reserved							
3	(MSB)							
4				Block Address				
5								
6								(LSB)
7	Reserved							
8	Partition							
9	Control							

LOCATE command causes the drive to position the logical unit to the specified block address in a specified partition. Upon completion, the logical position shall be after the specified location. Prior to performing the locate operation, the drive shall ensure that all buffered data, File-marks, and Set-marks have been transferred to tape.

BT: A block address type (BT) bit=1 is not supported and shall be set to ZERO otherwise a CHECK CONDITION with an ILLEGAL REQUEST sense key will be returned.

CP: A change partition (CP) bit of one indicates that a change to the partition specified in the partition field is to occur prior to positioning to the block specified in the block address field. A CP bit of ZERO indicates no partition change is to be made and the partition field is to be ignored.

Immed: An immediate (Immed) bit of ZERO indicates that the drive shall not return status until the locate operation has completed. An Immed bit of one indicates that the drive shall return status as soon as all buffered commands have completed execution and the command descriptor block of the LOCATE command has been validated. If CHECK CONDITION status is returned for a LOCATE command with an Immed bit of one, the locate operation shall not be performed.

Block Address: The Block Address field specifies the block address to which the drive shall be positioned on the tape.

Partition: The Partition field specifies which partition to select if the CP bit is one. Refer to the Mode Select command, Medium Partition page for additional information about partitioning. The partition is not support by the drive. If set to 1, a check condition status is returned with a ILLEGAL REQUEST sense key.

6.5. LOG SELECT 4Ch

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (4Ch)							
1	Obsolete			Reserved			PCR	SP (0)
2	PC		Reserved					
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	(MSB)	Parameter List Length						
8								(LSB)
9	Control							

The LOG SELECT command provides a means for the Host to manage statistical information maintained by the device about its own hardware or the installed media. This description should be read in conjunction with the description of the LOG SENSE command which follows it, to provide the reader with information about log page format, parameters and supported pages.

PCR: A Parameter Code Reset bit of one and a Parameter List Length of ZERO will cause ALL log pages which can be cleared, to be cleared. If this field is set and the Parameter List Length field is non-ZERO then the command will be terminated with a CHECK CONDITION status with the sense key set to ILLEGAL REQUEST, and an additional sense code of INVALID FIELD IN CDB.

SP: The device does not have non-volatile RAM into which it may save parameters. Therefore, the Save Page bit is not supported by this device and shall always be set to ZERO. If the SP bit is set, the command will be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST, and an additional sense code of INVALID FIELD IN CDB.

PC: The Page Control field defines the type of parameter values to be selected:

Table 6-5: Page Control field values

Value	Description
00b	Current Threshold Values
01b	Current Cumulative Values
10b	Default Threshold Values
11b	Default Cumulative Values

If this field is set to 00b, 10b or 11b and the Parameter List Length field is non-0 then the command will be terminated with a CHECK CONDITION status with the sense key set to ILLEGAL REQUEST, and an additional sense code of INVALID FIELD IN CDB. This is because no modification of these log pages is permitted. For a description of command behavior if this field is set to 01b then see the description of the Parameter List Length field below.

If this field is set to 10b and the Parameter List length field is 0 then all Current Threshold Values will be reset to the Default Threshold Values. This is equivalent to no change as Threshold Values cannot be modified.

If this field is set to 11b and the Parameter List Length field is 0 then all Current Cumulative Values will be reset to the Default Cumulative Values. This is equivalent to all log pages which can be cleared.

Parameter List Length: This field specifies the length in bytes of the LOG SELECT parameter list that shall be transferred from the initiator to the target during the DATA OUT phase. A parameter list length of ZERO indicates that no data shall be transferred. This condition shall not be considered as an error (see description of Parameter Code Reset and Page Control fields above). If this field is non-0 the Page Control field must be 01b.

The purpose of the Log Select command is to allow the initiator to modify and initialize parameters within the logs supported by the device. However in this case, access to individual parameters within log pages is not supported and so initiator is restricted to resetting complete log pages only.

To achieve this, during the DATA OUT phase the initiator must send the log page header of the page to be cleared, with the Page Length field set to ZERO. The following pages can be cleared in this manner.

Table 6-6: Page Codes

Page Code	Description
02h	Write Error Counter Page
03h	Read Error Counter Page
07h	Last n Error Events Page
2Eh	Tape Alert Log Page
34h	Write Frame Error Counter Page
35h	Read Frame Error Counter Page
39h	Data Compression Transfer Log Page
3Eh	MIC Variable Length Information Parameter Code

Note: Due to the way in which logs are stored and updated, clearing log page 2 will result in log page 3 also being cleared and vice versa.

Because of this method of clearing the log pages, the Parameter List Length field must be an integer multiple of the Log Page Header length (i.e. 4). Otherwise the command will be terminated with a CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and an additional sense code of INVALID FIELD IN CDB.

If multiple pages are sent during the DATA OUT phase then they must be sent in ascending order according to page code. Otherwise the command will terminate with a CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and an additional sense code of ILLEGAL FIELD IN PARAMETER LIST. The same status will be returned if an unsupported Page Code appears in any header or if the specified page cannot cleared.

Other Log Select Page Codes have been defined for MIC support. MIC Variable Length Information Page is assigned as 3Eh. Please refer the description for “Log Sense Page 3Eh” and Appendix (MIC) on this Product Specification Manual. User Volume Note and User Partition Note are automatically created with indicated size, if it is not exist. User Volume Note size and User Partition Note size must be the same size with current one, if it is already exist. Just only supersede operation is allowed.

Table 6-7: MIC Variable Length Information Parameter Codes

Parameter Code	Description	Length
0001h	User Volume Note	n-3
0002h	User Partition Note for Partition 0	n-3

1. See Important Note for Log Sense Page 3Eh.
2. If there is no User Volume Note and there is no User Partition Note, User Volume Note will be created for the specific Length if it does not exceed the Available Free Byte Count returned in Log Sense Page 3Dh Parameter Code 0003h. If there is existing User Volume Note and User Partition Note data the new User Volume Note data must be exactly the same size as the existing User Volume Note data, otherwise a Check Condition status will be returned and no new data will be written to MIC. If there is existing User Volume Note data but no User Partition Note data then User Volume Note length may be equal to the Available Free Byte Count.
3. There is no format to writing user data to MIC. The application is free to define MIC data for its use.

6.6. LOG SENSE 4Dh

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (4Dh)							
1	Obsolete			Reserved			PPC (0)	SP (0)
2	PC		Page Code					
3	(MSB)	Reserved						
4								
5	Parameter Pointer							
6								(LSB)
7	(MSB)	Allocation Length						
8								(LSB)
9	Control							

LOG SENSE provides a means for the Host to retrieve statistical information maintained by the device about its own hardware or the installed media. It is a complementary command to the LOG SELECT command.

SP: The device does not have non-volatile RAM into which it may save parameters. Therefore, the Save Page bit is not supported by this device and shall always be set to ZERO. If the SP bit is set, the command will be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST, and an additional sense code of INVALID FIELD IN CDB.

PPC: The Parameter Pointer Control bit shall always be set to ZERO. This indicates that the parameter data requested from the device will start with the parameter code specified in the Parameter Pointer field and return the number of bytes specified in the Allocation Length field in ascending order of parameter codes from the specified log page. A PPC bit of ZERO and a Parameter Pointer field of ZERO cause all available parameter data for that page code to be returned to the initiator. If the PPC bit is set or the Parameter Pointer is larger than the highest numbered parameter on the page, then the target shall terminate the command with CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall be set to INVALID FIELD IN CDB. If the drive does not support a parameter code within this page then it shall not return any data associated with this parameter.

PC: The Page Control field defines the type of parameter values to be selected. The page control field is defined below:

Table 6-8: Page Control field values

Value	Type of Parameter Values
00b	Current Threshold Values
01b	Current Cumulative Values
10b	Default Threshold Values
11b	Default Cumulative Values

The Current Threshold Values and the Default Threshold Values are non-changeable and will both return the same values-i.e. the maximum values that each parameter can attain. Note that for some parameters the term threshold value has no meaning. See the description of individual pages/ parameters below for more details.

The Current Cumulative Values are the values computed since the last reset of the device (either by power-cycling, BUS DEVICE RESET or SCSI RESET). Note that for some parameters these values cannot be reset by any method. See description of individual pages/parameters below for more details.

The Default Cumulative Values are the values to which each parameter gets initialized on a reset condition as described above. See description of individual pages/parameters below for more details.

Page Code: The Page Code field identifies which log page is being requested by the initiator. If the page is not supported then the command will terminate with a CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and an additional sense code of INVALID FIELD IN CDB.

Supported pages are:

Table 6-9: Supported Log Pages

Page Code	Description
00h	Supported Log Pages
02h	Write Error Counter Page
03h	Read Error Counter Page
07h	Last n Error Events Page
2Eh	Tape Alert Log Page
30h	Tape Log Page (Sony Unique)
31h	Tape Capacity Log Page
33h	Drive Usage Page (Sony Unique)
34h	Write Frame Error Counter Page
35h	Read Frame Error Counter Page
39h	Data Compression Transfer Log Page
3Ch	AIT Log Page
3Dh	AIT Fixed Length Information Page for MIC
3Eh	AIT Variable Length Information Page for MIC

Parameter Pointer: The Parameter Pointer field allows the host to specify at which parameter within a log page the requested data should begin.

For example if a page supported parameters 0 through 5, and the Parameter Pointer field contained 3 then only parameters 3, 4 and 5 would be returned to the initiator. Similarly, if a page supported parameters 1, 3 and 6, and the Parameter Pointer field contained 2, then only parameters 3 and 6 would be returned to the initiator.

Note that parameters within a page are always returned in ascending order according to parameter code. If an invalid parameter pointer is sent the drive will return CHECK CONDITION with the sense key set to ILLEGAL REQUEST and an additional sense code of INVALID FIELD IN CDB.

Allocation Length: The Allocation Length field is used to inform the target how much space the initiator has allocated for data. Note however that if this field is 0 then this is not considered an error and the device will just return a GOOD STATUS.

6.6.1. The Log Page Descriptor

The format of the log pages consists of ZERO or more variable-length parameter structures. Each page begins with a 4-byte page header followed by ZERO or more variable-length parameter structures defined for that page. The Log Select command supports the ability to send ZERO or more log pages. The LOG SENSE command returns a single log page as specified in the Page Code field of the CDB.

Table 6-10: Log Page Format

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code					
1	Reserve							
2	(MSB)		Page Length (n-3)					
3								(LSB)
	Log Parameters (s)							
4 x+3	The First Log Parameter (Length x)							
	.							
n-y n	The Last Log Parameter (Length y)							

Page code: Identifies which page of data is being transferred. If the Page Code field value is reserved or not implemented by the target, the target shall terminate the command with a CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST, and the additional sense code shall be set to INVALID FIELD IN PARAMETER LIST.

Page Length: The Page Length field indicates the total number of bytes that follow this byte. The value returned for this field depends on the value you specified for the Page Code and the Parameter Pointer in the CDB. This value is independent of what you specified for the Allocation Length. A Page Length value that results in the truncation of any parameter shall cause the target to terminate the command with CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall be set to INVALID FIELD IN PARAMETER LIST.

6.6.2. The Log Parameter Descriptor

Most log pages contain one or more special data structures called log parameters. These may be data counters which record the occurrence of certain events, or they may be more complex structures which describe activities or other events which occur within the device. Each parameter structure begins with a 4-byte parameter header followed by one or more bytes of parameter structure data. The 4-byte header is shown below:

Table 6-11: Log Parameter

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)		Parameter Code					
1								(LSB)
2	DU	DS (1)	TSD	ETC (0)	TMC (00)		LBIN	LP
3	Parameter Length (n-3)							
4	Parameter Value							
n								

Parameter Code: Identifies which parameter of data is being transferred. If the parameter code value is reserved or not implemented by the target, then the target shall terminate the command with CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall be set to INVALID FIELD IN PARAMETER LIST.

The DU, DS, TSD, ET, TMC, and LP fields are collectively referred to as the control byte.

DU: The DU bit (Disable Update) is not defined for threshold values (indicated by the PC field of the LOG SENSE command descriptor block). The target shall ignore the value of any DU bits in a LOG SELECT command.

DS: The DS (Disable Save) bit informs the initiator that savable parameters are disabled (i.e. not supported), and should always be 1. If it is 0 the command will terminate with CHECK CONDITION status with sense key set to ILLEGAL REQUEST and additional sense code of ILLEGAL FIELD IN PARAMETER LIST.

TSD: A target save disable (TSD) bit of ZERO indicates a target-defined method for saving log parameters. This implicit saving operation shall be done frequently enough to insure that the cumulative parameter values retain statistical significance (i.e. across power cycles). A TSD bit of one indicates that either the target does not provide a target-defined method for saving log parameters or the target-defined method has been disabled by the initiator. If the initiator sets both the DS and the TSD bits set to one, the target shall terminate the command with CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST with the additional sense code set to INVALID FIELD IN PARAMETER LIST.

ETC: An enable threshold comparison (ETC) bit of one indicates that when the cumulative parameter value is updated, it shall be compared to the threshold parameter value and the action specified by the TMC field shall be taken. An (ET) bit of ZERO disables this comparison. The ET bit is the same for both the cumulative and threshold log parameter. Thus when the ET bit is set to a value by the initiator, this value is returned for both the cumulative and threshold values of the log parameter.

TMC: The threshold met criteria (TMC) field defines the binary relationship between the cumulative and threshold log parameter values under which the threshold is met. If the ET bit is one and the threshold condition is met, a Unit Attention condition shall be posted to all initiators. When reporting the unit attention condition, the target shall set the sense key to UNIT ATTENTION, the additional sense code to LOG EXCEPTION, and the additional sense code qualifier to THRESHOLD CONDITION MET.

The TMC field is the same for both the cumulative and threshold parameter. Thus when the TMC field is set to a value by the initiator, this value is returned for both cumulative and threshold values of the log parameter.

Table 6-12: Threshold Met criteria

TMC	Threshold Met Criteria
00b	Any update of the parameter
01b	Cumulative = Threshold
10b	Cumulative < > Threshold
11b	Cumulative > Threshold

LP: The LP bit field defines whether the parameter is a data counter or a list parameter. See the description of each supported page below for information on the setting of this field.

Note: If any of the other bit-fields in the control byte are set then the command will terminate with a CHECK CONDITION status with a sense key of ILLEGAL REQUEST and an additional sense code of INVALID FIELD IN PARAMETER LIST

6.6.3. Supported Log Pages

The following log pages are supported:

Table 6-13: Supported Log pages

Page Code	Description
00h	Supported Log Pages
02h	Write Error Counter Page
03h	Read Error Counter Page
07h	Last n Error Events Page
2Eh	Tape Alert Log Page
30h	Tape Log Page (Sony Unique)
31h	Tape Capacity Log Page
33h	Drive Usage Log Page (Sony Unique)
34h	Write Frame Error Counter Page
35h	Read Frame Error Counter Page
39h	Transfer Log Page
3Ch	AIT Log Page
3Dh	AIT Fixed Length Information Page for MIC
3Eh	AIT Variable Length Information Page for MIC

A description of each supported log page is given below.

6.6.3.1. Summary List of Supported Pages

The summary list of supported log pages returns the list of page codes supported by the target. This page is only valid for the Log Sense command and if sent to the host during a Log Select command will cause termination with CHECK CONDITION status with sense key set to ILLEGAL REQUEST and additional sense code of INVALID FIELD IN PARAMETER LIST.

Table 6-14: Supported Log Pages

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (00h)					
1	Reserved (00h)							
2	(MSB)	Page Length (00 0Eh)						
3								(LSB)
4	Supported Page List							
17	(00 02 03 07 2E 30 31 33 34 35 39 3C 3D 3Eh)							

This page returns the summary list of supported log pages for the specified logical unit to the requesting initiator.

IMPLEMENTORS NOTE: Typically, an initiator should first request page ZERO to determine the list of pages supported by the device. The page code parameters are a list containing the page codes of the supported pages for the logical unit in ascending order. Note that neither Threshold nor Cumulative values have any meaning for this page.

6.6.4. Write and Read Error Counters Pages

The Error Counters Pages (Write and Read) are used to report statistical information about Write and Read soft and hard errors and retries. Each parameter is a counter which is updated by the target every time the corresponding event occurs. The format of the Error Counters Pages is given below:

Table 6-15: Write/Read Error counters page

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (02h or 03h)					
1	Reserved							
2	(MSB)	Page Length (n)						
3								(LSB)
4	(MSB)	Parameter Code						
5								(LSB)
6	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (00)		LBIN (0)	LP (0)
7	Parameter Length (n-3)							
8	(MSB)	Parameter Value						
N								(LSB)

The Page Code is one of the following:

Table 6-16: Page Code

Page Code	Description
02h	Write error Counter Page
03h	Read error Counter Page

The following parameter codes are supported for each Error Counters Page:

Table 6-17: Error Counter parameter codes

Parameter Code	Description	Parameter Length (Bytes)	Default Cumulative	Default Threshold
0003h	Total Errors Corrected (Soft Errors)	4	0	FFFFFFFFh
0004h	Total Times Correction	4	0	FFFFFFFFh
0005h	Total Groups Processed (Algorithm Processed)	4	0	FFFFFFFFh
0006h	Total Errors Uncorrected (Hard Errors)	4	0	FFFFFFFFh

6.6.5. Last N Error Events List

This page is used to report information on soft and hard errors encountered by the device during normal operation. Each parameter corresponds to an encountered error and is a report of what type of error occurred and when it occurred. The format of the page is given below:

Table 6-18: Last N Error Events Page

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (07h)					
1	Reserved							
2	(MSB)	Page Length (n*14)						
3								(LSB)
4	(MSB)	Parameter Code						
5								(LSB)
6	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (00)		LBIN (0)	LP (0)
7	Parameter Length (0Ah)							
8	Parameter Value							
17								

The Parameter Codes supported are 1 through 30 where 30 is the maximum number of entries in the log page.

If there are no entries, the command will return the Page Header with the Page Length field set to ZERO.

Each error event record contains diagnostic information for a single error encountered by the device. The parameter codes associated with the error-event records indicate the order in which the errors occurred. A higher parameter code indicates that the error event occurred later in time.

Each parameter entry is 10 bytes long and has the following format:

Table 6-19: Error Event format

Byte Offset	Meaning
0 – 4	Result Message (see Diagnostic Clause)
5	Unused
6 – 9	Time-stamp (number of 1 minute increments since power-on)

When the log page becomes full, no more entries will be added until the log is cleared (using one of the methods described previously) or a reset occurs. The current cumulative values will be returned regardless of the page control field in the LOG SENSE CDB.

6.6.6. Tape Alert Log Page

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (2Eh)					
1	Reserved							
2	(MSB)	Page Length (140h)						
3								(LSB)
5n-1	(MSB)	Parameter Code (n)						
5n								
5n+1	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (00)		LBIN (0)	LP (0)
5n+2	Parameter Length (1)							
5n+3	Value of Flag							

The value of *n* in the Parameter Code field shall be in the range of 1 to 64.

A value of one in the Value of Flag field indicates the flag is set.

Each flag will be cleared to zero in the following conditions:

- At power on cycle
- When Tape Alert Log page is read
- When specified corrective action has been performed
- SCSI bus reset or Bus Device Reset message
- Log Select reset

There are three types of flags, listed below in order of increasing severity:

Table 6-20: Tape Alert flag types

Severity	Urgent User Intervention	Risk of Data Loss	Explanations
C (Critical)	X	X	
W (Warning)		X	X
I (Information)			X

Tape Alert Log Page Parameter Codes

Code	Flag	Type	Flag Type	Recommended application client message	Probable cause
01h	Read Warning	O	W	The tape drive is having problems reading data. No data has been lost, but there has been a reduction in the performance of the tape.	The drive is having severe trouble reading
02h	Write Warning	O	W	The tape drive is having problems writing data. No data has been lost, but there has been a reduction in the capacity of the tape.	The drive is having severe trouble writing
03h	Hard Error	M	W	The operation has stopped because an error has occurred while reading or writing data, which the drive cannot correct.	The drive had a hard read or write error
04h	Media	M	C	Your data is at risk: 1. Copy any data you require from this tape. 2. Do not use this tape again. 3. Restart the operation with a different tape.	Media can no longer be written/read, or performance is severely degraded
05h	Read Failure	M	C	The tape is damaged or the drive is faulty. Call the tape drive supplier helpline.	The drive can no longer read data from the tape
06h	Write Failure	M	C	The tape is from a faulty batch or the tape drive is faulty: 1. Use a good tape to test the drive. 2. If the problem persists, call the tape drive supplier helpline.	The drive can no longer write data to the tape
07h	Media Life	M	W	The tape cartridge has reached the end of its calculated useful life: 1. Copy any data you need to another tape 2. Discard the old tape.	The media has exceeded its specified life
08h	Not Data Grade	O	W	The tape cartridge is not data-grade. Any data you back up to the tape is at risk. Replace the cartridge with a data-grade tape.	The drive has not been able to read the MRS stripes
09h	Write Protect	O	C	You are trying to write to a write-protected cartridge. Remove the write-protection or use another tape.	Write command is attempted to a write protected tape
0Ah	No Removal	O	I	You cannot eject the cartridge because the tape drive is in use. Wait until the operation is complete before ejecting the cartridge.	Manual or s/w unload attempted when prevent media removal on
0Bh	Cleaning Media	O	I	The tape in the drive is a cleaning cartridge.	Cleaning tape loaded into drive
0Ch	Unsupported Format	O	I	You have tried to load a cartridge of a type that is not supported by this drive.	Attempted loaded of unsupported tape format, e.g. DDS2 in DDS1 drive
0Dh	Recoverable Snapped Tape	O	C	The operation has failed because the tape in the drive has snapped: 1. Discard the old tape. 2. Restart the operation with a different tape.	Tape snapped/cut in the drive where media can be ejected
0Eh	Unrecoverable Snapped Tape	M	C	The operation has failed because the tape in the drive has snapped: 1. Do not attempt to extract the tape cartridge. 2. Call the tape drive supplier helpline.	Tape snapped/cut in the drive where media cannot be ejected
0Fh	Memory Chip in Cartridge Failure	O	W	The memory in the tape cartridge has failed, which reduces performance. Do not use the cartridge for further backup operations.	Memory chip failed in cartridge
10h	Forced Eject	M	C	The operation has failed because the tape cartridge was manually ejected while the tape drive was actively writing or reading.	Manual or forced eject while drive actively writing or reading
11h	Read Only Format	O	W	You have loaded a cartridge of a type that is read-only in this drive. The cartridge will appear as write-protected	Media loaded that is read-only format

Code	Flag	Type	Flag Type	Recommended application client message	Probably cause
12h	Tape Directory Corrupted on Load	O	W	The directory on the tape cartridge has been corrupted. File search performance will be degraded. The tape directory can be rebuilt by reading all the data on the cartridge	Tape drive powered down with tape loaded, or permanent error prevented the tape directory being updated
13h	Nearing Media Life	O	I	The tape cartridge is nearing the end of its calculated life. It is recommended that you: 1. Use another tape cartridge for your next backup. 2. Store this tape cartridge in a safe place in case you need to restore data from it.	Media may have exceeded its specified number of passes
14h	Clean Now	M	C	The tape drive needs cleaning: 1. If the operation has stopped, eject the tape and clean the drive 2. If the operation has not stopped, wait for it to finish and then clean the drive. Check the tape drive user's manual for device specific cleaning instructions.	The drive thinks it has a head clog, or needs cleaning
15h	Clean Periodic	O	W	The tape drive is due for routine cleaning: 1. Wait for the current operation to finish. 2. Then use a cleaning cartridge. Check the tape drive user's manual for device specific cleaning instructions.	The drive is ready for a periodic clean
16h	Expired Cleaning Media	M	C	The last cleaning cartridge used in the tape drive has worn out: 1. Discard the worn out cleaning cartridge. 2. Wait for the current operation to finish. 3. Then use a new cleaning cartridge.	The cleaning tape has expired
17h	Invalid Cleaning Tape	O	C	The last cleaning cartridge used in the tape drive was an invalid type: 1. Do not use this cleaning cartridge in this drive. 2. Wait for the current operation to finish. 3. Then use a valid cleaning cartridge.	Invalid cleaning tape type used
18h	Retention Requested	O	W	The tape drive has requested a retention operation	The drive is having severe trouble reading or writing, which will be resolved by a retention cycle
19h	Dual-Port Interface Error	O	W	A redundant interface port on the tape drive has failed	Failure of one interface port in a dual-port configuration, e.g. Fibre channel
1Ah	Cooling Fan Failure	O	W	A tape drive cooling fan has failed.	Fan failure inside tape drive mechanism or tape drive enclosure
1Bh	Power Supply	O	W	A redundant power supply has failed inside the tape drive enclosure. Check the enclosure user's manual for instructions on replacing the failed power supply.	Redundant PSU failure inside the tape drive enclosure or rack subsystem
1Ch	Power Consumption	O	W	The tape drive power consumption is outside the specified range	Power consumption of the tape drive is outside specified range
1Dh	Drive Maintenance	O	W	Preventive maintenance of the tape drive is required. Check the tape drive user's manual for device specific preventive maintenance tasks or call the tape drive supplier helpline.	The drive requires preventative maintenance (not cleaning).

Code	Flag	Type	Flag Type	Recommended application client message	Probable cause
1Eh	Hardware A	O	C	The tape drive has a hardware fault: 1. Eject the tape or magazine. 2. Reset the drive. 3. Restart the operation.	The drive has a hardware fault that requires reset to recover.
1Fh	Hardware B	M	C	The tape drive has a hardware fault: 1. Turn the tape drive off and then on again. 2. Restart the operation. 3. If the problem persists, call the tape drive supplier helpline. Check the tape drive user's manual for device specific instructions on turning the device power on and off.	The drive has a hardware fault which is not read/write related or requires a power cycle to recover.
20h	Interface	O	W	The tape drive has a problem with the host interface: 1. Check the cables and cable connections. 2. Restart the operation.	The drive has identified an interfacing fault
21h	Eject Media	O	C	The operation has failed: 1. Eject the tape or magazine. 2. Insert the tape or magazine again. 3. Restart the operation.	Error recovery action
22h	Download Fail	O	W	The firmware download has failed because you have tried to use the incorrect firmware for this tape drive. Obtain the correct firmware and try again.	Firmware download failed
23h	Drive Humidity	O	W	Environmental conditions inside the tape drive are outside the specified humidity range	Drive humidity limits exceeded
24h	Drive Temperature	O	W	Environmental conditions inside the tape drive are outside the specified temperature range	Drive temperature limits exceeded
25h	Drive Voltage	O	W	The voltage supply to the tape drive is outside the specified range	Drive voltage limits exceeded
26h	Predictive Failure	O	C	A hardware failure of the tape drive is predicted. Call the tape drive supplier helpline.	Predictive failure of drive hardware
27h	Diagnostics Required	O	W	The tape drive may have a fault. Check for availability of diagnostic information and run extended diagnostics if applicable. Check the tape drive users manual for instructions on running extended diagnostic tests and retrieving diagnostic data	The drive may have had a failure which may be identified by stored diagnostic information or by running extended diagnostics (e.g. Send Diagnostic)
28h	Loader Hardware A	O	C	The changer mechanism is having difficulty communicating with the tape drive: 1. Turn the autoloader off then on. 2. Restart the operation. 3. If problem persists, call the tape drive supplier helpline.	Loader mechanism is having trouble communicating with the tape drive
29h	Loader Stray Tape	O	C	A tape has been left in the autoloader by a previous hardware fault: 1. Insert an empty magazine to clear the fault. 2. If the fault does not clear, turn the autoloader off and then on again. 3. If the problem persists, call the tape drive supplier helpline.	Stray tape left in loader after previous error recovery
2Ah	Loader Hardware B	O	W	There is a problem with the autoloader mechanism.	Loader mechanism has a hardware fault

Code	Flag	Type	Flag Type	Recommended application client message	Probable cause
2Bh	Loader Door	O	C	The operation has failed because the autoloader door is open: 1. Clear any obstructions from the autoloader door. 2. Eject the magazine and then insert it again. 3. If the fault does not clear, turn the autoloader off and then on again 4. If the problem persists, call the tape drive supplier helpline.	Tape changer door open
2Ch	Loader Hardware C	O	C	The autoloader has a hardware fault: 1. Turn the autoloader off and then on again. 2. Restart the operation. 3. If the problem persists, call the tape drive supplier helpline. Check the autoloader users manual for device specific instructions on turning the device power on and off.	The loader mechanism has a hardware fault that is not mechanically related.
2Dh	Loader Magazine	O	C	The autoloader cannot operate without the magazine. 1. Insert the magazine into the autoloader 2. Restart the operation.	Loader magazine not present
2Eh	Loader Predictive Failure	O	W	A hardware failure of the changer mechanism is predicted. Call the tape drive supplier helpline.	Predictive failure of loader mechanism hardware
32h	Lost Statistics	O	W	Media statistics have been lost at some time in the past	Drive or library powered down with tape loaded
33h	Tape directory invalid at unload	O	W	The tape directory on the tape cartridge just unloaded has been corrupted. File search performance will be degraded The tape directory can be rebuilt by reading all the data.	Error prevented the tape directory being updated on unload.
36h	No start of data	O	C	The start of data could not be found on the tape: 1. Check you are using the correct format tape 2. Discard the tape or return the tape to your supplier	Tape damaged, bulk erased, or incorrect format

6.6.7. Tape Log Page (Sony Unique)

This page is a Sony unique page which provides information on the tape currently being used. This log cannot be cleared and has the following format:

Table 6-21: Tape Log Page

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (30h)					
1	Reserved							
2	(MSB)	Page Length (98h)						
3								(LSB)
4	(MSB)	Parameter Code						
5								
6	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (00)		LBIN (0)	LP (0)
7	Parameter Length (m)							
8	Parameter Value							
3+m								

This page is used to return Tape Log information to the host in a format which conforms to the LOG SENSE command page format.

Supported Parameter Codes in this page are listed below along with their meanings:

Table 6-22: Tape Log parameter codes

Parameter Code	Description	Length
001h	Current Groups Written	8
002h	Current Rewritten Tracks	8
003h	Current Groups Read	8
004h	Current C3 ECC Count	8
005h	Previous Groups Written	8
006h	Previous Rewritten Tracks	8
007h	Previous Groups Read	8
008h	Previous C3 ECC Count	8
009h	Total Groups Written	8
00Ah	Total Rewritten Tracks	8
00Bh	Total Groups Read	8
00Ch	Total C3 ECC Count	8
00Dh	Load Count	4

This information is contained within RAM in the Drive Controller. The log is updated as the tape is used.

The term 'current' refers to information generated during the current load of the tape; 'previous' refers to information generated during the last tape load; 'total' refers to information generated during the life of the tape since it was first initialized including the current load.

Use: An estimate of reading and writing performance can be made by the ratios of 'Total Groups Written' to 'Rewritten Tracks' and 'Groups Read' to 'C3 ECC Count'. An indication of tape degradation can be gained by comparing these ratios for 'current', 'previous' and 'total' entries.

Any attempt to change this page using LOG SELECT will result in a CHECK CONDITION with a Sense Key of ILLEGAL REQUEST. The current cumulative values will be returned regardless of the Page Control field in the LOG SENSE CDB.

6.6.8. Tape Capacity Log Page (Sony Unique)

The tape Capacity Log Page is used to indicate the approximate capacity of the tape currently being used. The PC field of the LOG SENSE command is ignored for this field.

When the AIT bit is set to ZERO in Mode Sense Page 31h, the 36 bytes of the log page shall be returned.

When the AIT bit is set to ONE, the 1028 bytes of the log page shall be returned.

The 36 bytes of the log page have the following format.

Table 6-23: Tape Capacity Log Page

Bit / Byte	7	6	5	4	3	2	1	0
0	Page Code (31h)							
1	Reserved (0)							
2	(MSB)	Page Length (00 20h when AIT bit =0						
3		04 00h when AIT bit =1)						(LSB)
4	(MSB)	Parameter Code						
5								(LSB)
6	DU (0)	DS (1)	TSD (1)	ETC (0)	TMC (11)		LBIN (0)	LP (0)
7	Parameter Length (04h)							
8	(MSB)	Parameter Value						
11								(LSB)

Tape Capacity Log Page Parameters:

Table 6-24: Tape Capacity Log Parameter Codes

Parameter Code	Description
0001	Remaining capacity, partition 0 (kilobytes)
0002	Reserved
0003	Maximum capacity, partition 0 (kilobytes)
0004	Reserved

6.6.9. Drive Usage Log Page (Sony Unique)

This page is a SONY unique page which provides information on the drive currently being used. This log cannot be cleared and has the following format.

Table 6-25: Drive Usage Log Page

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (33h)					
1	Reserved							
2	(MSB)	Page Length (0244h)						
3								(LSB)
4	(MSB)	Parameter Code						
5								(LSB)
6	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (00)		LBIN (0)	LP (0)
7	Parameter Length (m)							
8	Parameter Value							
7+m								

This page is used to return the vendor unique Drive Usage Log information to the host in a format which conforms to the Log Sense command page format.

Supported Parameter Codes in this page are listed below with their meaning:

Table 6-26: Drive Usage Supported Parameter Codes

Code	Description	Length	Default Cumulative	Default Threshold
0001h	Power on minutes	4	00000000h	FFFFFFFFh
0002h	Drum revolution minutes	4	00000000h	FFFFFFFFh
0003h	Fan revolution minutes	4	00000000h	FFFFFFFFh
0004h	Reserved	4	n/a	n/a
0005h	Load count	4	00000000h	FFFFFFFFh
0006h	Thread count	4	00000000h	FFFFFFFFh
0007h	MD serial number	4	n/a	
0008h	All board revision number	8	n/a	
0009h	Drive serial number	4	n/a	
000ah	Mechanism motion count (pinch on count)	4	00000000h	FFFFFFFFh
000bh	Cleaning Request Flag and Interval (minutes)	4	00000000h	FFFFFFFFh
000ch	EEPROM written count 1	4	00000000h	FFFFFFFFh
000dh	EEPROM written count 2	4	00000000h	FFFFFFFFh
000eh	Reserved	4	n/a	n/a
000fh	Reserved	4	n/a	n/a
0010h	Reserved	4	n/a	n/a
0011h- 0020h	Last 16 Mechanism Error Event List	8×16	n/a	

Cleaning Request Flag and Interval Parameter Format

Byte 3								Byte 2								Byte 1								Byte 0							
b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0
↔	←——— Drum Rotation Time Interval from the last cleaning (minutes) ———→																														

Cleaning Request Status (1 = Request)

All board revision number is 8 bytes long and has a following format:

Table 6-27: All Board Revision Number Parameter Format

0 1	Set revision
2 3	Board revision
4 5	Mechanism revision
6 7	RF revision

Each Mechanism Error Event is 24 bytes long and has following format:

Table 6-28: Mechanism Error Event Format

Byte offset	Meaning
0-3	Drum revolution minutes
4	Last mc Command
5-6	Error code
7	Reserved

6.6.10. Read and Write Frame Error Counter Page

The Read and Write Error Counter Page has the following format. All fields in these logs are initialized to ZERO in the following circumstances:

At Power On
After a cassette loading
After a user sends a request for initialization through Log Select
After a SCSI Bus Reset

Following configuration for error rate testing

Table 6-29: Read and Write Frame Error Counter Page

Bit Byte	7	6	5	4	3	2	1	0
0	Page Code (34h Write Frame Error Counters, 35h Read Frame Error Counters)							
1	Reserved							
2	(MSB)	Page Length (88h)						
3								(LSB)

Error Counter Descriptors

Bit Byte	7	6	5	4	3	2	1	0
0	(MSB)	Parameter Code						
1								(LSB)
2	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (0)		LBIN (0)	LP (0)
3	Parameter Length (4)							
4	(MSB)	Parameter Value						
7								(LSB)

Parameter Code: This identifies which parameter of data is being transferred. The following codes are supported for each Error Counter Page.

Parameter Code	Length	Default Cumulative	Default Threshold
0001h Frame Read or Write	4	0	FFFFFFFFh
0002h Main Data SYMN Block Errors CH1	4	0	FFFFFFFFh
0003h Main Data SYMN Block Errors CH2	4	0	FFFFFFFFh
0004h Reserved	4	0	FFFFFFFFh
0005h Reserved	4	0	FFFFFFFFh
0006h Reserved	4	0	FFFFFFFFh
0007h Reserved	4	0	FFFFFFFFh
0008h Total Retry Count (Read Only)	4	0	FFFFFFFFh
0009h C2 un-correctable Block (Read Only)	4	0	FFFFFFFFh
000Ah SYMN Block Errors R1	4	0	FFFFFFFFh
000Bh SYMN Block Errors R2	4	0	FFFFFFFFh
000Ch SYMN Block Errors R3	4	0	FFFFFFFFh
000Dh SYMN Block Errors R4	4	0	FFFFFFFFh
000Eh Reserved	4	0	FFFFFFFFh
000Fh Reserved	4	0	FFFFFFFFh
0010h Reserved	4	0	FFFFFFFFh
0011h Reserved	4	0	FFFFFFFFh

Block_Error_Rate [CH1] = Param0002h / (Param0001h×N)

Block_Error_Rate [CH2] = Param0003h / (Param0001h×N)

Block_Error_Rate [R1] = Param000Ah / (Param0001h×N/2)

Block_Error_Rate [R2] = Param000Bh / (Param0001h× N/2)

Block_Error_Rate [R3] = Param000Ch / (Param0001h× N/2)

Block_Error_Rate [R4] = Param000Dh / (Param0001h× N/2)

[N] AIT4 Tape: N = 206

The Format of this log page is shown in Table 6-30

Table 6-30: Read and Write Frame Error Counter Page Header format

Bit / Byte	7	6	5	4	3	2	1	0
0	Page Code (34h Write Frame Error Counters, 35h Read Frame Error Counters)							
1	Reserved							
2	(MSB)	Page Length (88h)						
3								(LSB)

The Error Counter Parameter format is shown in Table 6-31

Table 6-31: Read and Write Frame Error Counter Page Parameter format

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)	Parameter Code						
1								(LSB)
2	DU (0b)	DS (1b)	TSD (0b)	ETC (0b)	TMC (00b)		LBIN (0b)	LP (0b)
3	Parameter Length (4)							
4	(MSB)	Parameter Value						
7								(LSB)

6.6.11. Data Compression Transfer Log Page (Sony Unique)

The page allows the host to monitor the performance of the ALDC compression. The PC field in LOG SENSE determines whether current cumulative, or current/default threshold values are returned. The page has the following format:

Table 6-32: Data Compression Transfer Log Page

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (39h)					
1	Reserved							
2	(MSB)	Page Length (58h)						
3								(LSB)
4	(MSB)	Parameter Code (n)						
5								(LSB)
6	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (00)		LBIN (0)	LP (0)
7	Parameter Length (4)							
8	(MSB)	Parameter Value						
11								(LSB)

Data Compression Log Page Fields:

Supported Parameter Codes in this page and their meanings are as follows:

Code	Description
0001h	Number of entities written
0002h	Number of entities read
0003h	Number of records written
0004h	Number of records read
0005h	Megabytes to data compression
0006h	Megabytes from data compression
0007h	Megabytes to tape
0008h	Megabytes from tape
0009h	Logical entity size
000Ah	Physical entity size
000Bh	Uncompressed entities

Entities Written/Read: The total number of complete entities written to or read from the tape since the last power-on or Clear Log operation.

Records Written/Read: The total number of records (both compressed and uncompressed) written to or read from the tape since the last power-on or Clear Log operation.

Kilobytes to/from Data Compression: The total number of kilobytes written to or read from the tape since the last power-on or Clear Log operation. For Kilobytes from Data Compression, this number may be greater than the number of kilobytes transferred to the host due to read ahead.

Logical Entity Size: The logical size of the last entity written to or read from the tape: size = number of record in entity × record size in bytes

Physical Entity Size: The physical size of the last entity written to or read from the tape: size = entity header length + uncompressed data length

Uncompressed Entities: The total number of times non-ALDC entities have been encountered on the tape during read operations since the last power-on or Clear Log operation.

6.6.12. AIT Log Page (Sony Unique)

This page is for the AIT original Tape Log. The AIT Tape Log of each fields are larger than legacy Tape Log Page. The legacy Tape Log Page returns the part of AIT original. This page indicated the Partition Information at the current Partition.

Table 6-33: AIT Log Page

Bit / Byte	7	6	5	4	3	2	1	0
0	Page Code (3Ch)							
1	Reserved							
2	(MSB)	Page Length (n+1)						
3								(LSB)

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)	Parameter Code (0001h - 0012h and 0101h - 0112h)						
1								(LSB)
2	DU (0)	DS (1)	TSD (0)	ET (0)	TMC (00)		LBIN (0)	LP (0)
3	Parameter Length (n-3)							
4	(MSB)	Parameter Value						
N								(LSB)

Parameter Code:

Code	Description	Length
0001h	Current Groups Written	8
0002h	Current Rewritten Tracks	8
0003h	Current Groups Read	8
0004h	Current C3 ECC Count	8
0005h	Previous Groups Written	8
0006h	Previous Rewritten Tracks	8
0007h	Previous Groups Read	8
0008h	Previous C3 ECC Count	8
0009h	Total Groups Written	8
000Ah	Total Rewritten Tracks	8
000Bh	Total Groups Read	8
000Ch	Total C3 ECC Count	8
000Dh	Load Count	4
000Eh	Access Count	4
000Fh	Update Replace Count	8
0010h	Last Valid Absolute Frame Number	8
0011h	Partition Attribute	8
0012h	Maximum Absolute Frame Number	8

Previous Groups Written: This is the number of groups physically written to the tape or partition since the last update of the System area. Where Repeat Writing is in force, this count increments for each instance.

Total Groups Written: This is the total number of groups physically written to the tape or partition since the first time the tape or partition was written. The number accumulates over the life of the tape but is ZEROed by a format pass. Where Repeat Writing is in force, this count increments for each instance.

Previous Groups Read: This is the number of groups physically read from the tape or partition since the last update of the System area.

Total Groups Read: This is the total number of groups physically read from the tape or partition since the first time the tape or partition was written. This does not include any reading as part of a Read-After-Write check. The number accumulates over the life of the tape but is ZEROed by a format pass.

Total Rewritten Frames: This is the total number of frames on the tape or within the partition that were needed to be rewritten since the tape or partition was first written. It is incremented by 1 each time a frame is repeated following error detection by the Read-After-Write process. This count does not include any frames which are written between the original frame and its rewrite. The number accumulates over the life of the tape but is ZEROed by a format pass.

Total 3rd ECC Count: This is the number of groups which have been physically read and data has not been recovered without requiring the use of C3 correction since the first time the tape or partition was written. The number accumulates over the life of the tape but is ZEROed by a format pass.

Access Count: This is the number of times the drive accesses the partition. The both an "Unload" and a "Change Partition" is the event for incrementing the Access Count counter.

Update Replace Count: This is the number of times the drive update the partition.

Previous Rewritten Frames: This is the number of frames on the tape or within the partition that were needed to be rewritten since the last update of the System area. It is incremented by 1 each time a frame is repeated following error detection by the Read-After-Write process. This count does not include any frames which are written between the original frame and its rewrite.

Previous 3rd ECC Count: This is the number of groups which have been physically read and data has not been recovered without requiring the use of C3 correction since the last update of the System area.

Load Count: This is the number of times the tape has been loaded since the first time a tape was written. One load consists of threading the media around the drum of the drive mechanism, positioning the tape ready for use and later unthreading the media. The number accumulates over the life of the tape but is ZEROed by a format pass. This field is Reserved in the System Log of Partition 0 of a multiple partitioned tape.

Last Valid Absolute Frame Number: This field shall specify the Absolute Frame Number which is the number of Frames written since the beginning of the partition, excluding any Frames that are written in the test area. The first Frame of the Reference area is the first Frame after the Logical Beginning-Of-Tape (LBOT) point of the current partition and has an Absolute Frame Number of 1. Any discontinuous or repeated numbers shall occur only in an Amble Frame sequence.

Maximum Absolute Frame Count: This field shall specify the Absolute Frame Number of the last Frame of the last EOD Area as the Maximum Absolute Frame Number. After that, the Maximum Absolute Frame Number is equal to the Valid Maximum Absolute Frame Number, because the whole data area in the partition contains valid data. The Maximum Absolute Frame Number shall not be changed as long as the partition size is the same.

Partition Attributes: Both Log Sense and Log Select are available for this field. This field shall specify the attribute of the partition as follows.

6.6.13. MIC Fixed Length Information Page (Sony Unique)

Table 6-34: MIC Fixed Length Information Page

Bit / Byte	7	6	5	4	3	2	1	0
0	Page Code (3Dh)							
1	Reserved							
2	(MSB)	Page Length (n+1)						
3								(LSB)

Parameter Code:

Code	Description	Length
0001h	MIC Logical Format Type	4
0002h	Device Configuration bits	4
0003h	Available free byte count	4
0004h	User Volume Note size	4
0005h	Reserved	8
0006h	Cassette Serial Number, etc.	32
0007h	Reserved	32
0008h	Reserved	32
0009h	Reserved	32
000Ah	Reserved	32
000Bh	Reserved	32
000Ch	Reserved	32
000Dh	Reserved	32
000Eh	Reserved	32
000Fh	Reserved	32
0010h	Reserved	32
0011h	Reserved	32
0012h	Reserved	32
0013h	Reserved	32
0014h	User Partition Note Map	32
0015h	Accumulative System Log	96
0016h	Volume Information	96
0017h	Element Address	4
0018h	User Partition Note size for Partition #0	4

Note:

1. Parameter Code 0002h AIT Device Configuration Byte is the same byte value returned in Mode Sense Page 31h byte 2. See page 6-58 paragraph 6.8.1 for a description of the fields in this byte.
2. Parameter Code 0003h Available Free Byte Count represents the current user MIC memory that is available for writing data to the MIC using the Log Select command through Page 3Eh Parameter Code 0001h, 0002h, …. 000Nh. If Available Free Byte Count is 1 or higher the application may use exactly that size or smaller to write MIC User data. If this field is ZERO a Check Condition status is returned if attempts are made to write data to the MIC. If the application attempts to write data to the MIC that is larger than this field a Check Condition status will also be returned. In both cases where Check Condition status is returned no data is written to the MIC.
3. Parameter Code 0014h List of Partitions is a bit map field that represents all 256 partitions. Below is a diagram of the bit map ordering of the Partition Note data. A "1" in the bit field for the partition indicates there is Partition Note in MIC; a "0" in the bit field indicates there is no Partition Note in MIC for that partition. As an example, if partition 0 and partition 1 have Notes data Byte #0 below will be 0C0h, and Byte #1 to #31 will be 00h.

4. Parameter Code 0017h Drive Element Address data field is reserved. The drive always returns ZERO for this field.

0	(MSB)	Parameter Code (0001h)					
1							(LSB)
2	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (00)	LBIN (0)	LP (0)
3	Parameter Length (2)						
4	(MSB)	MIC Logical Format Type					
7							(LSB)

0	(MSB)	Parameter Code (0002h)					
1							(LSB)
2	DU (0)	DS 1)	TSD (0)	ETC (0)	TMC (00)	LBIN (0)	LP (0)
3	Parameter Length (2)						
4	Reserved						
5	AIT	DEVICE	ABS	ULPBOT	PRTH	PONEJ	SysLogAlive
6	(MSB)	Reserved					
7							(LSB)

0	(MSB)	Parameter Code (0003h)					
1							(LSB)
2	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (00)	LBIN (0)	LP (0)
3	Parameter Length (2)						
4	(MSB)	Available Free Byte Count					
7							(LSB)

0	(MSB)	Parameter Code (0004h)					
1							(LSB)
2	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (00)	LBIN (0)	LP (0)
3	Parameter Length (2)						
4	(MSB)	User Volume Note Size					
7							(LSB)

0	(MSB)	Parameter Code (0005h)					
1							(LSB)
2	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (00)	LBIN (0)	LP (0)
3	Parameter Length (8)						
4	(MSB)	Reserved					
7							(LSB)

0	(MSB)	Parameter Code (0006h)					
1							(LSB)
2	DU (0)	DS (0)	TSD (1)	ETC (0)	TMC (00)	LBIN (0)	LP (1)
3	Parameter Length (36)						
4	(MSB)	Cassette Serial Number (ASCII Code)					
35							(LSB)

0	(MSB)	Parameter Code (0007h – 0013h)					
1							(LSB)
2	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (00)	LBIN (0)	LP (0)
3	Parameter Length (36)						
4	(MSB)	Reserved					
35							(LSB)

0	(MSB)	Parameter Code (0014h)					
1		(User Partition Note Map)					(LSB)
2	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (00)	LBIN (0)	LP (0)
3	Parameter Length (32)						
4	(msb for the Partition 0)	64 bits of Map					
11							(lsb for the Partition 63)
12	Reserved						
35							

0	(MSB)	Parameter Code (0015h)					
1		(Accumulative System Log)					(LSB)
2	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (00)	LBIN (0)	LP (0)
3	Parameter Length (62)						
4	(MSB)						
	CURRENT AMOUNT OF DATA WRITTEN						
9							(LSB)
10	(MSB)						
	The CURRENT WRITE RETRIES COUNT						
15							(LSB)
16	(MSB)						
	CURRENT AMOUNT OF DATA READ						
21							(LSB)
22	(MSB)						
	CURRENT READ RETRIES COUNT						
27							(LSB)
28	(MSB)						
	PREVIOUS AMOUNT OF DATA WRITTEN						
33							(LSB)
34	(MSB)						
	PREVIOUS WRITE RETRIES COUNT						
39							(LSB)
40	(MSB)						
	PREVIOUS AMOUNT OF DATA READ						
45							(LSB)

46 51	(MSB) PREVIOUS READ RETRIES COUNT (LSB)
52 57	(MSB) TOTAL AMOUNT OF DATA WRITTEN (LSB)
58 63	(MSB) TOTAL WRITE RETRIES COUNT (LSB)
64 69	(MSB) TOTAL AMOUNT OF DATA READ (LSB)
70 73	(MSB) TOTAL READ RETRIES COUNT (LSB)
74 81	(MSB) LOAD COUNT (LSB)
82 87	(MSB) TOTAL CHANGE PARTITION COUNT (LSB)
88 93	(MSB) TOTAL PARTITION INITIALIZE COUNT (LSB)

0	(MSB)	Parameter Code (0016h)					
1		(Volume Information)					(LSB)
2	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (00)	LBIN (0)	LP (0)
3	Parameter Length (94)						
4-23	Reserved (Eject Status)						
24-27	Reserved (Reel Diameter)						
28	Reserved						
29-31	Initialize Count						
32	Reserved			ABS	SysLogAlive	ULPBOT	AIT
33	Last Partition Number						
34	(msb for Partition 0)	64 of bit array					
41							(lsb for Partition 64)
42-99	Reserved						

0	(MSB)	Parameter Code (0017h)					
1		(Element Address)					(LSB)
2	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (00)	LBIN (0)	LP(0)
3	Parameter Length (4)						
4	(MSB)	SDX-900V always return 00 00 00 00h					
7							(LSB)

0	(MSB)	Parameter Code (0018h)					
1		(User Partition Note for Partition 0)					(LSB)
2	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (00)	LBIN (0)	LP (0)
3	Parameter Length (2)						
4	(MSB)	User Partition Note Size for Partition 0					
9							(LSB)

6.6.14. MIC Variable Length Information Page (Sony Unique)

Page 3Eh is a variable length page. That is not defined by ANSI. This page is Sony Vendor Unique.

Important NOTE:

1. Only one Parameter Code in Page 3Eh is transferred at a time.
2. Byte position 3 of Parameter Code in the Page 3Eh is Reserved. (Should be set to ZERO.)
3. Parameter Length for the contents of the Parameter Code in Page 3Eh is stored at the byte position 4 and 5.
4. The Page Length field in the Page Code indicates the total number of bytes that follow this byte. This value is independent of what is specified for the Allocation Length in the CDB.

Table 6-35: MIC Variable Length Information Page

Bit / Byte	7	6	5	4	3	2	1	0
0	Page Code (3Eh)							
1	Reserved							
2	(MSB)	Page Length (n-3)						
3								(LSB)

Parameter Code	Description
0001h	User Volume Note
0002h	User Partition Note for Partition 0

0	(MSB)	Parameter Code (0001h)					
1		(User Volume Note)					(LSB)
2	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (00)	LBIN (1)	LP (1)
3	Reserved						
4	(MSB)	User Data Length					
5							(LSB)
6	(MSB)	User Data					
N							(LSB)

0	(MSB)	Parameter Code (0002h)					
1		(User Partition Note for Partition #0)					(LSB)
2	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (00)	LBIN (1)	LP (1)
3	Reserved						
4	(MSB)	User Data Length					
5							(LSB)
6	(MSB)	User Data					
N							(LSB)

Note:

1. If there is no Note data in MIC for the Parameter Code specified in the CDB a Check Condition status will be returned.
2. If the CDB allocation length is ZERO a Good status is always returned and there is no data phase.
3. If the CDB allocation length is non-ZERO and there is data in MIC for the Parameter Code data will be returned up to the size of the MIC data, as limited by the allocation length. For example, if the CDB allocation length is 0FFh and MIC data size for the Parameter Code is 020h 020h data will return. If the CDB allocation length is 010h and the MIC data size for the Parameter Code is 020h only 010h data will be returned.

6.7. MODE SELECT(6/10) 15h and 55h

Mode Select 6 CDB Format:

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (15h)							
1	Obsolete			PF	Reserved			SP (0)
2	Reserved							
3	Reserved							
4	Parameter List Length							
5	Control							

Mode Select 10 CDB Format:

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (15h)							
1	Obsolete			PF	Reserved			SP (0)
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	Parameter List Length (MSB)							
8	Parameter List Length (LSB)							
9	Control							

MODE SELECT enables the Host to configure the drive. Similarly MODE SENSE enables the Host to identify which configuration parameters the drive supports and what its current configuration is. Implementing MODE SELECT and MODE SENSE requires a certain amount of "handshaking" between the Host and the drive. Before configuring the drive, the Host should issue a MODE SENSE. This allows the drive to return its current configuration and indicate what parameters are configurable. The Host interprets this information and may then issue a MODE SELECT command to set up the drive to the Host's preferred configuration.

Note: In the MODE SELECT and MODE SENSE (operation code 1Ah) descriptions much of the information overlaps and therefore the two descriptions should be read in conjunction.

MODE SELECT allows the initiator to specify configuration parameters to the drive.

The drive always powers-up with its default configurations set. This is also true, if the drive receives a BUS DEVICE RESET message or a hard reset through the RST line on the SCSI bus.

PF: The Page Format bit indicates that the data sent by the Host after the MODE SELECT header and block descriptors complies with the definition of pages as set out in SCSI-2 or SCSI-3.

SP: The Save Parameters bit instructs the drive to save all savable pages. This bit is not supported and the drive will return a CHECK CONDITION status with an ILLEGAL REQUEST sense key, if it is set.

Parameter List Length: This specifies the length, in bytes, of the MODE SELECT parameter list that is transferred during the DATA OUT phase. A ZERO parameter list length indicates that no data is transferred. The Parameter List length must be a value which coincides with header, block descriptor or page boundaries. If this does not occur then the drive will return a CHECK CONDITION status with an ILLEGAL REQUEST sense key set.

The MODE SELECT parameter list shown below, contains a four-byte header, followed by one eight-byte block descriptor.

Table 6-36: MODE SELECT parameter list

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved							
1	Reserved							
2	Reserved	Buffered Mode (001b)			Speed (00h)			
3	Block Descriptor Length (08h)							
4	Density Code							
5	(MSB)	Number of Blocks (00 00 00h)						
6								
7								(LSB)
8	Reserved							
9	(MSB)	Block Length						
10								
11								(LSB)

Buffered Mode: Buffered Mode is the mechanism by which the drive implements Immediate Reporting on WRITE commands.

If the field is ZERO, then the drive does not report a GOOD status on WRITE commands until the data blocks are actually written to tape (not support).

If the Buffered Mode field is one, then the drive reports GOOD status on WRITE commands as soon as the data block has been transferred to the buffer. This field should be set to ONE.

Speed: The drive only supports one speed, the default speed. Because of this, this field must be set to ZERO. Any other value will cause a CHECK CONDITION status with an ILLEGAL REQUEST sense key is returned.

Block Descriptor Length: This specifies the length in bytes of all the block descriptors. Since the drive only allows one block descriptor, this value must be eight. Any other value will cause a CHECK CONDITION status with an ILLEGAL REQUEST sense key to be returned.

Note: The block descriptor specifies the media characteristics for the SDX drive. The block descriptor contains the density code, number of blocks and block length fields.

Density Code: The supported values for the density code field are defined in the following table.

Note: 00h - Default: The use of the word “Default” is SCSI specific. It instructs the drive to use its default or only density.

Table 6-37: Sequential-Access Density Codes

Code Value	Code Value
00h	Default Format
30h	AIT-1 Format
31h	AIT-2 Format
32h	AIT-3 Format
33h	AIT-4 Format
7Fh	No change from previous density

Number of Blocks: A MODE SENSE field which will be returned as ZERO, indicating that all of the remaining logical blocks on the media will have the medium characteristics specified by the block descriptor, or until a subsequent MODE SELECT command changes those parameters. This field must be set to ZERO on a MODE SELECT otherwise a CHECK CONDITION status will be returned with an ILLEGAL REQUEST sense key.

Block length: The Block Length field specifies the length in bytes of each logical block transferred over the SCSI bus. A block length of ZERO indicates that the length is variable. Any other value indicates the number of bytes per block that the drive must handshake over the bus. This establishes block length such that the transfer length for read, write type commands will be a block count not a byte count.

Note: It is value of this field together with the Fixed Bit Field in the READ, or WRITE commands that determine whether the drive is in Fixed or Variable block mode.

Mode	Fixed Bit in Read, Write	Block Length in Mode Select/Sense
Fixed Block	1	Block Size
Variable Block	0	0

The default fixed block size is 0 bytes however, if a fixed command (fixed bit of ONE) is received, the drive will return the CHECK CONDITION status with an ILLEGAL REQUEST sense key and the additional sense code shall be set to COMMAND SEQUENCE ERROR.

Note: Minimum block-size is 4. The figures must be multiples of 4, otherwise CHECK CONDITION status will be return, and Sense Key will be ILLEGAL REQUEST.

Following the Block Descriptor are the MODE SELECT pages. They are the method by which the device parameters are set. Each page has a two byte header which identifies the page code and indicates the number of bytes in that page.

Table 6-38: MODE SELECT Page Header

Bit / Byte	7	6	5	4	3	2	1	0
0	PS	Reserved	Page Code					
1	Additional Page Length							

PS: when the Page Savable bit is set, this indicates that the page contains saved parameters. This bit will never be set as there is no non-volatile RAM on the drive into which parameter data may be saved.

The page codes that are supported are:

Table 6-39: Supported MODE SELECT Page Codes

Page Code	Description
00h	Standard Sense
02h	Disconnect-Reconnect
0Ah	Control Mode Page
0Fh	Data Compression Control
10h	Device Configuration
11h	Medium Partitions Parameter
1Ch	Information Exception Control
31h	AIT Device Configuration
32h	Append Partition (not support)
33h	Delete Partition (not support)
3Fh	Return All Pages

Additional Page Length: Indicates the number of bytes in that page. The value does not, however, include bytes 0 and 1. The length is returned on MODE SENSE and must subsequently be set to the same value when performing MODE SELECT.

If the page length does not match that expected by the drive a CHECK CONDITION status is returned with the sense key to set to ILLEGAL REQUEST.

The drive also returns a CHECK CONDITION status with an ILLEGAL REQUEST sense key if the Host sends an unsupported Page Code, a page field with values that are not supported or are not changeable. In this case, no parameters will have been changed by the command.

6.7.1. Disconnect-Reconnect Page (02h)

The drive supports the Disconnect-Reconnect Page which has the following format:

Table 6-40: Disconnect-Reconnect Page

Bit / Byte	7	6	5	4	3	2	1	0
0	PS(0)	Reserved	Page Code (02h)					
1	Page Length (0Eh)							
2	Buffer Full Ratio (00h)							
3	Buffer Empty Ratio (00h)							
4	(MSB)	Bus Inactivity Limit (00h)						
5								(LSB)
6	(MSB)	Disconnect Time Limit (0000h)						
7								(LSB)
8	(MSB)	Connect Time Limit (00h)						
9								(LSB)
10	(MSB)	Maximum Burst Size (4000h)						
11								(LSB)
12	Reserved		Fair Arbitration (00b)		Reserved		DTDC	
13	Reserved							
14	Reserved							
15	Reserved							

Buffer Full Ratio, Buffer Empty Ratio, Bus Inactivity Limit and Connect Time Limit fields are not supported by the drive if set to non-ZERO values a CHECK CONDITION status is returned with ILLEGAL REQUEST sense key set.

Disconnect Time Limit: This field indicates the minimum time in 100 microsecond increments that the drive shall wait after releasing the SCSI bus before attempting re-selection. This should be 0 and this is non-changeable field.

Maximum Burst Size: This field defines the maximum amount of data that the drive shall transfer during a data phase before disconnecting. This value is expressed in increments of 512 bytes. This is non-changeable field and should be 4000h.

Note: 512 (200h) × 16384 (4000h) = 8388608(8 Mbytes) which means that the Maximum Burst Size is approximately equal to SDX-900V Buffer size for SCSI side.

FAIR ARBITRATION: This field indicates whether the drive shall use fair or unfair arbitration when requesting an interconnect tenancy. Setting this field to 1 will enable the SCSI Bus Fairness protocol. Setting this field to zero will disable it. The drive determines fairness by monitoring prior arbitration attempts by other SCSI devices. It shall postpone arbitration for itself until all lower priority SCSI devices that previously lost arbitration either win a subsequent arbitration or discontinue their arbitration attempts. It shall monitor the arbitration attempts of the other SCSI devices and refresh the fairness register with the SCSI ID's of any lower priority SCSI devices that lost arbitration. This field is not support.

DTDC: This field defines further restrictions on when a disconnect is permitted.

DTDC	Description
00b	Data transfer disconnect control is not used. Disconnect is controlled by the other field in this page.
01b	A target shall not attempt to disconnect once the data transfer of a command has started until all data the command is to transfer has been transferred. The connect time limit and bus inactivity limit are ignored during the data transfer.
10b	Reserved
11b	A target shall not attempt to disconnect once the data transfer of a command has started until the command is complete. The connect time limit and bus inactivity limit are ignored once data transfer has started.

6.7.2. Control Mode Page (0Ah)

Bit / Byte	7	6	5	4	3	2	1	0
0	PS (0)	Reserved	Page Code (0Ah)					
1	Page Length (0Ah)							
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved					AUTOLOAD MODE		
6	Reserved							
7	Reserved							
8	Reserved							
9	Reserved							
10	Reserved							
11	Reserved							

The AUTOLOAD MODE field specifies the action to be taken by the drive when a media is inserted.

AUTOLOAD MODE field

Value	Definition
000b	Medium shall be loaded for full access
001b	Medium shall be loaded for medium auxiliary memory access only
010b	Medium shall not be loaded (not support)
011b-111b	Reserved

6.7.3. Data Compression Control Page (0Fh)

The drive supports the Data Compression Control Page which has the following format:

Table 6-41: Data Compression Control Page

Bit / Byte	7	6	5	4	3	2	1	0
0	PS (0)	Reserved	Page Code (0Fh)					
1	Page Length (0Eh)							
2	DCE	DCC (1)	Reserved					
3	DDE	RED (00h)		Reserved				
4	(MSB)	Compression Algorithm (0003h)						
7								(LSB)
8	(MSB)	Decompression Algorithm (0003h)						
11								(LSB)
12	Reserved							
13	Reserved							
14	Reserved							
15	Reserved							

Note: If the drive does not support compression the drive will return Check Condition status, and the sense key will be set to ILLEGAL REQUEST.

This page specifies the parameters for the control of the data compression capability of the drive.

DCE: A Data Compression Enable (DCE) bit of one indicates that data compression is enabled. When this bit is set, data sent to the device by the initiator shall be processed using the selected compression algorithm before being written to the medium. A DCE bit of ZERO indicates that data compression is disabled.

DCC: A Data Compression Capable (DCC) bit of one indicates that the drive supports data compression and shall process data sent to it for transferal to the medium using the selected compression algorithm when the DCE bit is one. A DCC bit of ZERO indicates that the device does not support data compression. This shall be a non-changeable field. The SDX-900V has the capability to decompress data and will set this bit to a one.

DDE: A Data Decompression Enable (DDE) bit of one indicates that data decompression is enabled. The SDX-900V will always decompress the data. Setting this bit to ZERO has no effect.

RED: The Report Exception on Decompression (RED) field indicates the device's response to a boundary condition caused by a change in the format of recorded data from:
uncompressed to compressed or compressed to uncompressed
This field is not supported and should be always set to 00b.

Compression Algorithm: The compression algorithm field indicates the compression algorithm the drive will use to process data sent to it by the initiator (if the DCE bit is one).

The SDX-900V supports the ALDC1 data compression algorithm which is identified by the value: 00 00 00 03h in the compression algorithm field. A value of ZERO shall indicate that no compression algorithm is currently selected. Any other values in this field will cause the drive to return a CHECK CONDITION status the sense key shall be set to ILLEGAL REQUEST.

Decompression Algorithm: For MODE SELECT the decompression algorithm field indicates the decompression algorithm selected by the initiator for use in subsequent decompression of data encountered on the medium.

The SDX-900V can decompress data recorded with the ALDC1 algorithm therefore this field can be set to 00 00 00 03h. However, the SDX-900V is capable of automatic recognition of the compression algorithm used to process the data encountered on the medium. Therefore, the drive will override the value in the decompression field (if is set to ZERO) for a subsequent read operation when ALDC1 compressed data is detected on the media.

For the MODE SENSE command, the decompression algorithm field reflects compression algorithm which was used to process the data most recently encountered on the medium, during a read operation.

A value of ZERO shall indicate that the data encountered on the medium during the most recent read operation was uncompressed.

6.7.4. Device Configuration Page (10h)

The drive supports the Device Configuration Page which has the following format:

Table 6-42: Device Configuration Page

Bit / Byte	7	6	5	4	3	2	1	0
0	PS (0)	Reserved	Page Code (10h)					
1	Page Length (0Eh)							
2	Reserved	CAP	CAF (0)	Reserved				
3	Active Partition							
4	Write Buffer Full Ratio (00h)							
5	Read Buffer Empty Ratio (00h)							
6	(MSB)	Write Delay Time (64h)						
7								(LSB)
8	DBR (0)	BIS (1)	RSmk	AVC (0)	SOCF (00b)		RBO (0)	REW
9	Gap Size (00h)							
10	EOD Defined (000b)			EEG (1)	SEW	Reserved		
11	(MSB)	Buffer Size at Early Warning (00 00 00h)						
12								
13								(LSB)
14	Select Data Compression Algorithm (0x00)							
15	Reserved							

CAP: The Change Active Partition bit, when set to one, indicates that the partition is changed to the one specified by the Active Partition Field. This is a feature supported by the drive and is discussed below.

CAF: The Change Active Format bit, set to one, indicates that the active format is to be changed to that set in the Active Format Field. This field is not supported.

Active Partition: Indicates the current partition number in use on the medium.

Setting this field to a non-existing partition number will be rejected by the drive with a CHECK CONDITION status and the ILLEGAL REQUEST sense key set.

Write Buffer Full Ratio and Read Buffer Empty Ratio: These fields are not supported by the drive. Setting these fields to anything other than ZERO will cause the drive to return a CHECK CONDITION status and an ILLEGAL REQUEST sense key.

The drive implements an algorithm which automatically adjusts these ratios so as to maximize streaming to the Host.

Write Delay Time: This field indicates the maximum time, in 100 millisecond increments, that the drive shall wait with a partially full buffer before forcing the data to tape. The drive defaults to a 10 second delay since the last SCSI bus activity before the data is flushed from the buffer to the tape. If Write Delay Time is set to ZERO the drive will wait indefinitely for the data group to be filled.

DBR: This field is not supported and should be always set to ZERO.

BIS: Block Identifiers Supported is set to one to indicate that the media has recorded information about the logical block ID relative to the partition.

The DBR and BIS bit are only valid on a MODE SENSE command where they are used to report drive capabilities. These bits are ignored by the drive on a MODE SELECT command. The drive will not return a CHECK CONDITION.

RSmk: The Report Set Mark bit, when set to one, indicates that Set Marks will be reported to the drive. When ZERO, Set Marks are NOT reported. The default is one, Set Marks reported.

AVC: Automatic Velocity Control function is not supported by the drive and if this bit is set a CHECK CONDITION status is returned with an ILLEGAL REQUEST sense key.

SOCF: Stop on Consecutive File-marks function is not supported by the drive and if this bit is set a CHECK CONDITION status is returned with an ILLEGAL REQUEST sense key.

RBO: This field is not supported. If this bit is set a CHECK CONDITION status is returned with an ILLEGAL REQUEST sense key.

REW: The Report Early-Warning End-of –Media bit is set to ZERO indicates the drive will not report the early-warning condition on reads but will report early-warning on writes before the physical End-Of –Partition. The REW bit is changeable. A value of ONE indicates that the drive will report the early-warning condition on writes and reads.

Gap Size: This field is not used by the SDX-900V and shall be set to ZERO otherwise a CHECK CONDITION with an ILLEGAL REQUEST sense key will be returned.

EOD Defined: This field shall always be set to ZERO so that the drive will use its default EOD definition to detect and generate EOD. Any other value will cause the drive to return a CHECK CONDITION status with an ILLEGAL REQUEST sense key set.

EEG: The Enable EOD Generation bit shall always be set to indicate that drive will generate an EOD. The drive generates an EOD mark prior to any change of direction, if that change follows a write-type operation. This bit is only valid on the MODE SENSE command where it is used to report drive capabilities. This bit is ignored by the drive on a MODE SELECT command. The drive will not return a CHECK CONDITION.

SEW: The Synchronize at Early-Warning bit is set to ONE indicates buffered write data, File-marks and Set-marks at or after Early-Warning End-of-Media will be written to the Medium. The SEW bit changeable. A value of ZERO indicates that the target will retain any unwritten buffered data, File-marks, or Set-marks in the buffer when logical Early-Warning is encountered. The default is 1.

Buffer Size at Early Warning: This field is not supported by the drive and if set a CHECK CONDITION status is returned with an ILLEGAL REQUEST sense key set.

Select Data Compression Algorithm: The SDX-900V supports the Data Compression Page and that page should be used instead of this field to control Data Compression. This field is not supported by the drive and if set a CHECK CONDITION status is returned with an ILLEGAL REQUEST sense key set.

6.7.5. Medium Partitions Parameter Page (11h)

The drive supports the Medium Partitions Parameter Page, which has the following format:

Table 6-43: Medium Partitions Parameter Page

Bit / Byte	7	6	5	4	3	2	1	0
0	PS (0)	Reserved	Page Code (11h)					
1	Page Length (0Ah)							
2	Maximum Additional Partitions (0h)							
3	Additional Partitions Defined (00h)							
4	FDP (0)	SDP (0)	IDP	PSUM		Reserved		
5	Medium Format Recognition (03h)							
6	Reserved				Partition Units			
7	Reserved							
8	(MSB)	Partition Size (Partition 0)						
9								(LSB)
10	(MSB)	Partition Size (Partition 1)						
11								(LSB)

Warning: This page is used to format a tape to one partition. Extreme care must be used with this parameter page to avoid accidental reformatting of a tape. Reformatting will destroy all previous data.

Maximum Additional Partitions: This field is only valid on MODE SENSE where it is used to report the maximum number of additional partitions that are supported by the drive. This field is non-changeable, however it accepts all values as a don't care. This number is the maximum number of additional partitions supported.

Additional Partitions Defined: This field specifies the number of additional partitions to be defined for the tape based on the IDP bit. The maximum allowed is the value returned in the Maximum Additional Partitions field.

FDP: The Fixed Data Partitions bit is not supported by the drive and if set, a CHECK CONDITION status is returned with an ILLEGAL REQUEST Sense Key set.

SDP: The Select Data Partitions bit is not supported by the drive and if set, a CHECK CONDITION status is returned with an ILLEGAL REQUEST Sense Key set.

IDP: The Initiator Defined Partitions bit is supported and, when set to one, indicates that the tape shall be partitioned based on the Additional Partitions Defined field, PSUM and Partition Size field.

PSUM: The Partition Size Unit of Measured field defines the units in which the Partition Size value selects the partition size.

Table 6-44: PSUM values

Code	Description	Support
00b	bytes (unit of one)	Not Support
01b	kilobytes (10^3 bytes)	Not Support
10b	Megabytes (10^6 bytes)	Not Support
11b	$10^{(\text{PARTITION UNITS})}$ bytes	Optional

Partition Units: This field defines the size of the partition size descriptors when the PSUM field is set to 11b. A value of *n* in the PARTITION UNITS field shall define the units of the partition size descriptors as 10^n bytes.

SDX-900V Supports following combinations.

PSUM	Partition Units
11b	1001b: 10^9 byte

If another value is set these fields a CHECK CONDITION status is returned with an ILLEGAL REQUEST sense key set.

Medium Format Recognition: This field is only valid on a MODE SENSE and is set to 03h to indicate that the drive is capable of format and partition recognition. This is non-changeable field. It accepts all the value, however always returns 03.

Partition Sizes: This field allows the initiator to allocate the capacity of each partition. It will also allow the initiator to reallocate the capacity of previously partitioned tapes.

If the Additional Partitions Defined fields are set to ZERO the drive will reformat the tape.

The size of partition 0 is only valid during Mode Sense and is ignored during Mode Select. For Mode Select only partition 1 size is used when Additional Partitions Defined field is set to 01h. Partition 0 size is ignored. Internally, the drive computes partition 0 size to be the remaining capacity of the tape. This remaining capacity is the maximum uncompressed capacity minus partition 1 size.

A second way to issue Mode Select Page 11h is to set Page Length to 08h, and set bytes 8 and 9 to partition 1 size. In this method partition 0 size is not sent, but this size is still computed as defined above. In either case, Mode Sense will report partition 0 and partition 1 sizes.

6.7.6. Informational Exceptions Control Page (1Ch)

The Informational Exceptions control page defines the methods used by the target to control the reporting and the operations of specific informational exception conditions.

Table 6-45 : Informational Exceptions Control Page

Bit / Byte	7	6	5	4	3	2	1	0
0	PS(0)	Reserved	Page Code (1Ch)					
1	Page Length (0Ah)							
2	Perf(0)	Reserved (0)			DExcpt	Test	Reserved	LogErr (0)
3	Reserved				MRIE			
4	(MSB)	Interval Timer						
7	(00 00 00 00h)							(LSB)
8	(MSB)	Report Count/Test Flag Number						
11								(LSB)

LogErr: This field is not supported.

DE xcpt: The Disable Exception Control (DE xcpt) bit of ZERO indicates information operations shall be enabled. The reporting of information exception conditions when the Dexcpt bit is set to ZERO is determined from the method of reporting informational exception field. The Dexcpt bit of ONE indicates the drive shall be disable all information exception operations. The method of reporting informational exceptions field is ignored when Dexcpt is set to ONE.

Test: The Test bit of ZERO indicates the drive shall not generate any test/false informational exception condition. This bit of ONE indicates the drive shall generate test/false informational exception conditions. The default value of Test is ZERO.

Perf: The Performance bit (Per) of ZERO indicates that informational exception operations that are the cause of delays are acceptable. The Perf bit of ONE indicates the drive shall be set to ZERO otherwise a CHECK CONDITION with an ILLEGAL REQUEST sense key set.

MRIE: The Method of Reporting Informational Exceptions field (MRIE) indicates the method used by the drive to report informational exception conditions. If the informational exception condition was generated by an event that caused a real CHECK CONDITION to occur, then this real CHECK CONDITION will over-ride the CHECK CONDITION defined in MRIE modes. The drive supports value 0, 3 and 4.

When MRIE is set to 0, this method instructs the drive to not report informational exception conditions. When MRIE is set to 4 (Unconditionally generate RECOVERED ERROR), this method instructs the drive to report informational exception conditions by returning a CHECK CONDITION status on the next SCSI command (excluding INQUIRY, REQUEST SENSE and REPORT LUNS) after an informational exception condition was detected. The sense key shall be set to RECOVERED ERROR and the additional sense code shall indicate the cause of the information exception condition (which is 5D/00h). The command that has the CHECK CONDITION shall complete without error before any exception condition may be reported (and thus does not need to be reported).

Interval Timer: This field is not supported by the drive and if set a CHECK CONDITION status is returned with an ILLEGAL REQUEST sense key set.

Report Count /Test Flag Number: This field has a dual purpose. When Test bit is set to ZERO, the value of this field in the MODE SELECT data represents the Report Count. When a MODE SELECT command is sent with the Test bit it set to ONE, the value of this field in the MODE SELECT data represents the Test Flag Number, which is never returned in response to a MODE SENSE command. Valid values of Test Number are –64 to 64 and 32767 (7FFFh). Negative numbers are represented using the 2's complement method. If the Test Flag Number is set to an invalid value, the MODE SELECT command will return CHECK CONDITION, with sense key set to ILLEGAL REQUEST and extended sense set to Invalid Field in Parameter list.

6.7.7. AIT Device Configuration Page (31h)

Note 1: The values set by Mode Select Page 31h become valid after the Mode Select Page 11h command is completed.

Note 2: The values reported by Mode Sense Page 31h always indicate a status of the cassette. It is not a mode condition of the drive

Note 3: For initializing AIT native mode cassette, Mode Select Page 31h must be issued before Mode Select Page 11h.

Table 6-46: AIT Device Configuration Page

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (31h)					
1	Page Length (8)							
2	AIT	DEVICE	ABS (1)	ULPBOT	PRTH (0)	PONEJ (0)	SysLogAlive	
3	SPAN (0Ah)							
4	MIC	Reserved						
5	Reserved							
6	Reserved							
7	Reserved							
8	Reserved							
9	Reserved							

AIT

The AIT-bit is a changeable bit. The status of the AIT-bit is valid after a cassette is initialized. Until then the AIT-bit indicates ZERO, even if the bit is set with the Mode Select command.

0 - DDS emulation mode (default) (AIT4 Tape is not supported)

1 - AIT native mode

Device

0 - Do not create optional device area. (DDS mode only)

1 - Create optional device area. (AIT mode only)

ABS

0 - Do not create the Absolute Volume Map information. (Not Supported)

1 - Create and maintain the Absolute Volume Map information.

ULPBOT

0 - Load/unload is performed at the Optional Device Area, except for partition 0 (Not Supported).

1 - Load/ unload must be performed at the device area located at PBOT, even if there is an Optional Device Area. (default)

PRTH

0 - Allow Thread; Thread the tape after cartridge insertion, and return ready status. (default)

1 - Prevent Thread; Do not thread the tape after cartridge insertion, and return ready status immediately after the cartridge is loaded. The tape will automatically be threaded when a media access SCSI command (Erase, Locate, Mode Select Page 11h, Read, Read Position, Seek Block, Space, Write, and Write File-mark) is received from the host. (Not Supported)

PONEJ

This bit is recorded in drive's EEPROM, and it effects the drive itself. (Not Supported)

0 - Power On immediate Eject disable. If this bit set to 0, then the cassette will stay in the drive when power is applied. (default)

1 - Power On immediate Eject enable. If this bit set to 1, then cassette will be immediately ejected when power is applied to the drive.

Span

The Span field is in binary notation. This field is unchangeable. When MIC cartridge is inserted, this field is set to 0Ah (00001010B), other values are prohibited.

SysLogAlive

0 0 - System logs located only on tape. (default for SDX-T3N)

1 1 - System logs located only in MIC. (default for MIC cartridge)

The SysLogAlive-bits shall be set to 00B for non-MIC cartridges, and to 11B for MIC cartridges. Other bit combinations are prohibited.

MIC

This bit is effective for Mode Sense only. If this bit is 0 then MIC has not been detected in the cassette.

Bit Combination Table

AIT	DEV	Description
0	0	Illegal
0	1	Illegal
1	0	Illegal
1	1	AIT Mode, Unload at PBOT

6.7.8. Append Partition (32h) (This mode page is NOT supported)

The Append Partition Command is available in the AIT mode. The Append Partition Command takes effect if the current partition is the last partition. When the command is issued in the last partition and then creates a new partition. If the command is issued in any other partition, SDX-900V will return the CHECK CONDITION status (83h/97h Current Partition is no the last partition).

Table 6-47: Append Partition Page

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (32h)					
1	Page Length (8)							
2	Reserved							
3	Reserved							
4	Reserved			PSUM		Reserved		
5	Reserved							
6	Reserved				Partition units			
7	Reserved							
8	(MSB)	Partition Size Descriptor						
9								(LSB)

PSUM

The Partition Size Unit of Measured field defines the units in which the Partition Size value selects the partition size.

Code	Description	Support
00b	bytes (unit of one)	Not Support
01b	kilobytes (10^3 bytes)	Not Support
10b	Megabytes (10^6 bytes)	Optional
11b	$10^{(\text{PARTITION UNITS})}$ bytes	Optional

Partition units

This field defines the size of the partition size descriptors when the PSUM field is set to 11b. A value of *n* in the PARTITION UNITS field shall define the units of the partition size descriptors as 10^n bytes.

SDX-900V Supports following combinations.

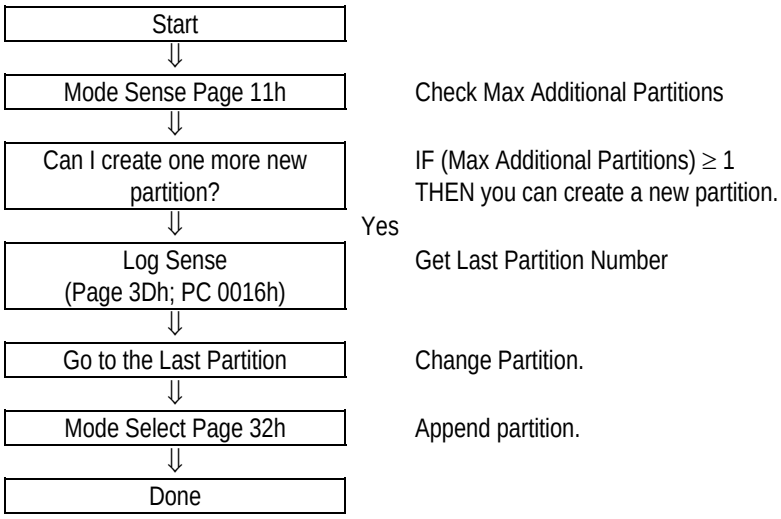
PSUM	Partition Units
11b	1001b : 10^9 byte (AIT-4 Mode)

If another value is set these fields a CHECK CONDITION status is returned with an ILLEGAL REQUEST sense key set.

Partition Size Descriptor

Partition size in megabytes, in binary notation. Bytes 8, 9: Partition Size Descriptor. For a Mode Sense Command, the value in this field is invalid unless the Mode Sense Command follows a successful Mode Select Command Page 32. Therefore, on power-up without a Mode Select Page 32h, the Current Page 32h Partition Size Descriptor should be set to the default value of 00 00. There is no relation between this field and the IDP bit in the parameter block of Mode Select Page 11h.

Append Partition example procedure:



Note 1: The partition to be appended inherits the conditions previously set by the Mode Select Page 31h.

Note 2: *Example 1*:

If the entire tape capacity is 200Gbyte.

This example does not contains formatting overhead. AIT mode tape with two partitions. P0 = 20 GB, P1 = 230 G. P1 contains 40 GB of old data. Mode Select Page 32h Append Partition Page indicates 5 GB for the partition size. After the Mode Select command returns Good status we have the following:

P0 = 20 GB
P1 = 40 GB(old data), + 10G of Append space = 50G
P2 = 230 GB – 50G = 180G

After this command completes Unit Attention condition will be set for other Initiators, with ASC/ASCQ set to 2A01, Mode Parameters changed. After this command Mode Sense page 11h will show the following:

Additional Partition = 2

P0 = 20 GB
P1 = 50 GB
P2 = 230 GB – 50 GB = 180 GB

Note 3: After partition appended, the Last Partition Number field of Volume Information in MIC indicates a valid value, while the value in the Last Partition Number field of Volume Information on tape is not valid.

Note 4: The Append Partition Page operation is not allowed when the WP tab is set.

Note 5: Append Partition Page writes all buffered data to tape, before appending a partition.

6.7.9. Delete Partition (33h) (This mode page is NOT supported)

Table 6-48: Delete Partition Page

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (33h)					
1	Page Length (8)							
2	Indicated Partition Number							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	Reserved							
8	Reserved							
9	Reserved							

SDX-900V rewinds the tape to Bottom of Active Partition, after Delete Partition.

Note 1: The Delete Partition Command is available in the AIT mode and only for an AIT mode cassette.

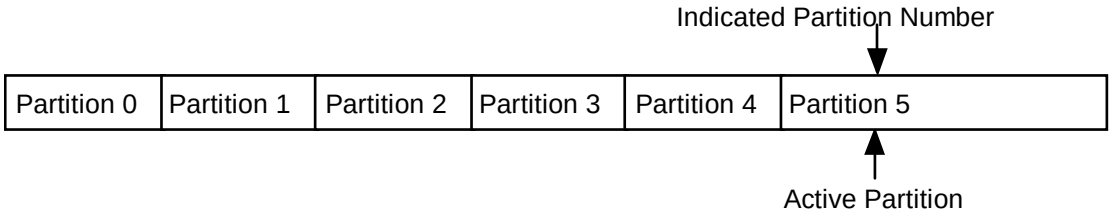
Note 2: The Indicated Partition Number value specifies the partition number above which partitions are to be deleted. Consequently, the value cannot represent the last, open-ended partition on tape. The specified partition itself is converted into an open-ended partition with its data contents preserved.

Note 3: Delete Partition is System area in the Active partition.

Examples:

Case 1;

With the tape already loaded, and with partition 5 active, the Delete Partition command issued with the Indicated partition Number set to 5 (the last partition) will be rejected with CHECK CONDITION (Illegal parameter). See Notes 2 and 3.

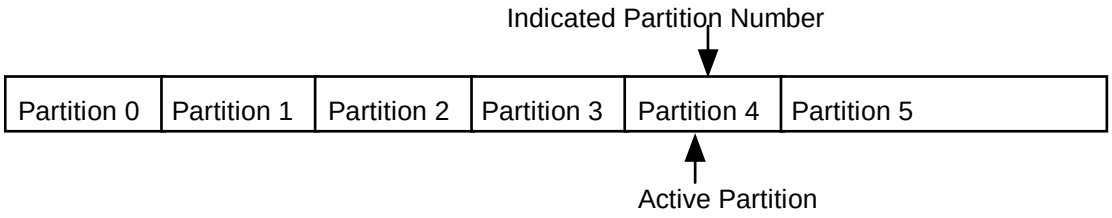


Case 2;

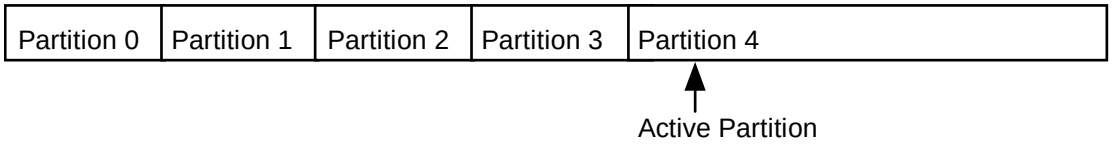
With the tape already loaded, and with partition 4 active, the Delete Partition command issued with the Indicated Partition Number set to 4 will delete partition 5. SDX-900V will change the value of 5 in the Last Partition Number field in the Volume Information in MIC to 4. No tape motion will take place. The new last partition - partition 4 - will become open-ended, spanning up to the EOM.

After the completion of this command, the Unit Attention condition will be set for other Initiators, with ASC/ASCQ set to 2A01, Mode Parameters changed, and Mode Sense Page 11h will show the following:

Old tape layout:



New tape layout:

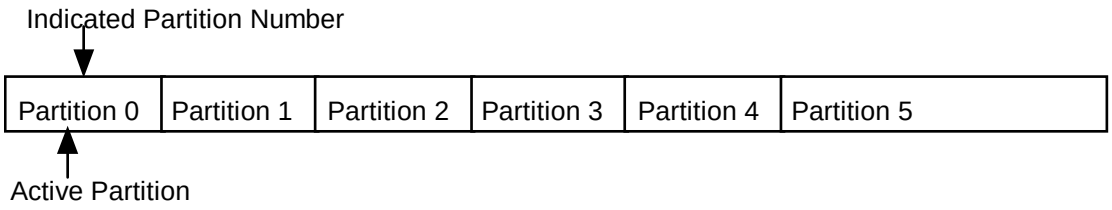


Case 3;

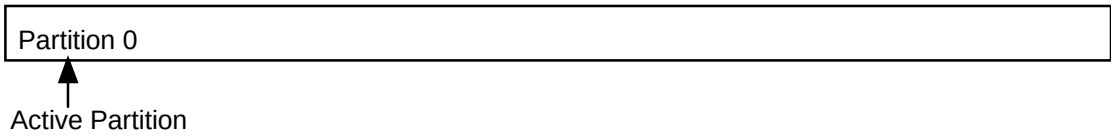
With the tape already loaded, and with partition 0 active, the Delete Partition command issued with the Indicated Partition Number set to 0 will delete partitions 1, 2, 3, 4, and 5. SDX-900V will change the value of 5 in the Last Partition Number field in the Volume Information in MIC to 0. No tape motion will take place.

After the completion of this command, the Unit Attention condition will be set for other Initiators, with ASC/ASCQ set to 2A01, Mode Parameters changed, and Mode Sense Page 11h will show the following:

Old tape layout:



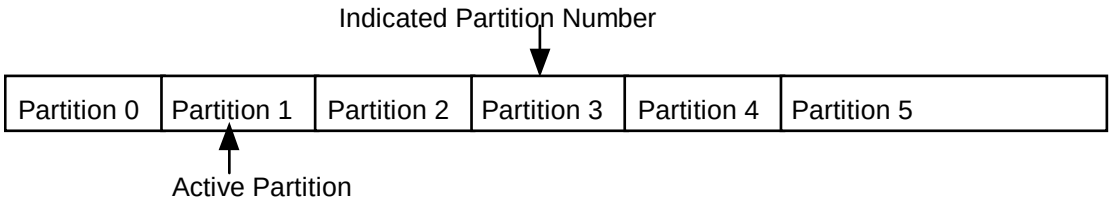
New tape layout:



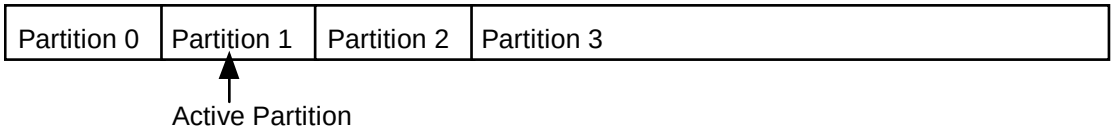
Case 4;

With the tape already loaded, and with partition 1 active, the Delete Partition command issued with the Indicated Partition Number set to 3 will delete partitions 4 and 5. SDX-900V will change the value of 5 in the Last Partition Number field in the Volume Information in MIC to 3. No tape motion will take place.

Old tape layout:

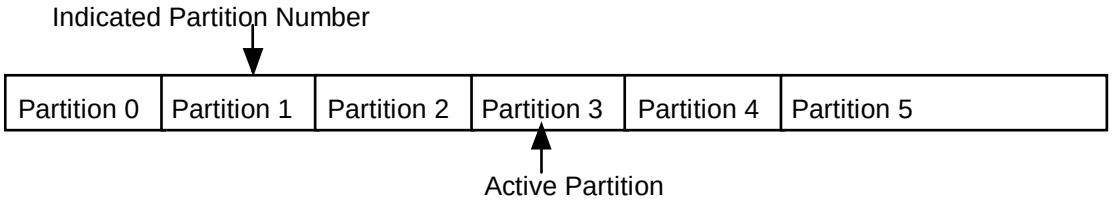


New tape layout:



Case 5 (with PRTH=0);

With the tape already loaded, and with partition 3 active, the Delete Partition command issued with the Indicated Partition Number set to 1 will be rejected with CHECK CONDITION. See Note 2.



6.8. MODE SENSE (6/10) 1Ah and 5Ah

Table 6-49: Mode Sense (6) CDB Format

	7	6	5	4	3	2	1	0
0	Operation Code (1Ah)							
1	Reserved				DBD	Reserved		
2	PCF		Page Code					
3	Reserved							
4	Allocation Length							
5	Vendor Specific (00b)		Reserved			NACA (0)	Flag (0)	Link (0)

Table 6-50: Mode Sense (10) CDB Format

	7	6	5	4	3	2	1	0
0	Operation Code (5Ah)							
1	Reserved			LLBAA (0)	DBD	Reserved		
2	PCF		Page Code					
3-6	Reserved							
7-8	Allocation Length							
5	Vendor Specific (00b)		Reserved			NACA (0)	Flag (0)	Link (0)

The MODE SENSE (6/10) commands provide a means to report its default, current and changeable configuration parameters. They are complementary to MODE SELECT (6/10) commands. The 6-byte and 10-byte commands can be interchanged.

The format of the data returned is different for the six and ten byte commands. See the MODE SELECT (6/10) commands for the mode header format differences.

LLBAA: The LLBAA function is not supported. This field must be ZERO. This field is defined for MODE SENSE 10 only.

If this field is not set to 0b for a MODE SENSE (10) command, the command terminates with CHECK CONDITION status, the sense key set to ILLEGAL REQUEST, the ASC/ASCQ is set to INVALID FIELD IN CDB.

DBD: A Disable Block Descriptors (DBD) bit of ZERO indicates that the target may return ZERO or more block descriptors in the returned MODE SENSE data at the target's discretion. A DBD bit of one specifies that the target shall not return any block descriptors in the returned MODE SENSE data.

PC: The Page Control field indicates the type of page parameter values to be returned to the Host as shown below.

Table 6-51: Page Control field values

Bit 7	Bit 6	Parameter Values	Description
0	0	Current Values	This is the normal default situation where the drive returns to the host its current configuration. Page fields not supported are set to ZERO by the drive.
0	1	Changeable Values	These are any values which a host may alter in a subsequent MODE SELECT command. Any field that the drive allows to be changed is set to one. Otherwise the field is set to ZERO.
1	0	Default Values	These are the default values on power-up
1	1	Saved Values	Not supported by the drive

The addition page length field of each page returned by the drive indicates the number of bytes supported for that page. Fields not supported by the drive are set to ZERO.

Page Code: This allows the Host to select any specific or all pages supported by the drive. The page codes that are supported are:

Table 6-52: Supported MODE SENSE Page Codes

Page Code	Description
00h	Standard Sense
02h	Disconnect-Reconnect
0Ah	Control Mode Page
0Fh	Data Compression Control
10h	Device Configuration
11h	Medium Partitions Parameter
1Ch	Informational Exception Control
31h	AIT Device Configuration
32h	Append Partition (Not Support)
33h	Delete Partition (Not Support)
3Fh	Return All Pages

If the Host selects any other values, the drive will terminate the command with a CHECK CONDITION status and an ILLEGAL REQUEST sense key set.

Note: If the Page Code is ZERO, the drive will only return the four-byte header and the one eight-byte block descriptor and terminate the command with GOOD status.

Allocation Length: The Allocation Length specifies the number of bytes that the HOST has allocated for returned MODE SENSE data. An Allocation Length of ZERO means that the drive will return no MODE SENSE data. This is not considered an error and GOOD status will be returned. Any other value indicates the maximum number of bytes that can be transferred. The drive terminates the DATA IN phase when the Allocation Length bytes have been transferred or when all available MODE SENSE data has been transferred to the initiator, whichever is less. The Allocation Length must fall on header or block descriptor boundaries. If the Allocation Length does not fall on these boundaries then the drive returns CHECK CONDITION status with the ILLEGAL REQUEST sense key set, unless the value is greater than that required for the specified page.

If the Page Code is ZERO, the Host requires MODE SENSE to only return the four-byte header the one eight-byte block descriptor, therefore the Allocation Length must be set to 0Ch. The value of the Page Control Field is then not checked by the drive and may be set to any value.

If the Allocation Length is non ZERO, it must be set to 4 or more. If the Allocation length is non ZERO and less than 4, the drive will return CHECK CONDITION status, and ILLEGAL REQUEST sense key.

The MODE SENSE data contains a four-byte header, followed by one eight-byte block descriptor, followed by ZERO or more variable length pages, depending on the Page Code and the Allocation Length.

Table 6-53: MODE SENSE data

Bit / Byte	7	6	5	4	3	2	1	0
0	Mode Data Length							
1	Medium Type (00h)							
2	WP	Buffered Mode (001b)			Speed (00h)			
3	Block Descriptor Length (08h)							
4	Density Code (33h)							
5	(MSB)	Number of Blocks (00 00 00h)						
6								
7								(LSB)
8	Reserved							
9	(MSB)	Block Length						
10								
11								(LSB)

Mode Data Length: The mode data length specifies the length in bytes of the following mode sense data that is available to be transferred during the DATA IN phase. The mode data length does not include itself but does include the total length of all requested MODE SENSE pages.

Media Type: The media value will be ZERO as only one media type is supported.

WP: A Write Protected bit of ZERO indicates that the tape is write enabled. A Write Protected bit of one indicates that the tape is write protected.

Buffered Mode: if this bit is set to ZERO, the drive will not report a GOOD status on WRITE commands until the data blocks are actually written on the tape. If set, the drive is in buffered mode and may report a GOOD status on WRITE commands as soon as the data block has been transferred to the drive's buffer. One or more blocks may be buffered prior to writing to the tape. (Not support)

If the Buffered Mode field is ONE, then drive reports GOOD status on WRITE commands as soon as the data block has been transferred to the buffer, this field should be set to ONE.

Speed Field: will return ZERO as the drive only supports one speed.

Block Descriptor Length: returns a value of 8, which specifies the length in bytes of the following Block Descriptor. The drive only returns a single Block Descriptor.

Density Code: The drive returns 30h, 31h, 32h, and 33h in the Density Code field.

Number of Blocks: The Number of Blocks field is ZERO, indicating that an unspecified (or unknown) number of the remaining logical blocks on the tape may have the media characteristics specified by the Block Descriptor.

Block Length: The Block Length field specifies the length in bytes of each logical block transferred over the SCSI bus. A Block Length of ZERO indicates that the length is variable. Any other value indicates the number of bytes per block that the drive must handshake over the bus. This establishes Block Length such that the Transfer Length for read, write command will be a block count not a byte count. Minimum Block Length is 2. If Block Length is 1, the drive will return the CHECK CONDITION status with an ILLEGAL REQUEST sense key.

Note: It is value of this field together with the Fixed Bit Field in the READ, or WRITE commands that determine whether the drive is in Fixed or Variable block mode. The minimum length is 4 and it always should be a multiple of 4.

Page Descriptor: The supported pages are fully documented in the MODE SELECT clause of this Chapter.

PS: When the Page Savable bit is set, this indicates that the page contains saved parameters. This bit will never be set as there is no non-volatile RAM on the drive into which parameter data may be saved.

All fields not supported by the drive must be set to ZEROs.

6.8.1. Mode Sense 31h (AIT Device Configuration Page)

Note 1: SDX-900V always reports the status of the cassette present in the drive, even if the mode values are changed.

Note 2: AIT-bit and DEV-bit values are changed after completing the Mode Select Page 11h.

Note 3: SDX-900V reports the following status for a virgin cassette:

Bits	SDX-T3N	MIC Cartridge
AIT	0	0
DEV	0	0
ULPBOT	1	1
PRTH	0	0
PONEJ	0	0
ABS	0	1
MIC	0	1
SysLogAlive	00B	11B

6.9. PERSISTENT RESERVE IN 5Eh

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (5Eh)							
1	Logical Unit Number			Reserved		SERVICE ACTION		
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	(MSB)			Allocation Length				
8								(LSB)
9	Unused (00b)			Reserved			Flag	Link

The PERSISTENT RESERV IN command is used to obtain about persistent reservations and reservation keys that are active within a drive.

The actual length of the PERSISTENT RESERVE IN parameter data is available in a parameter data field.

SERVICE ACTION: The service action codes are defined:

Table 6-54: PERSISTENT RESERVATION IN Service action codes

Code	Name	Description
00h	READ KEYS	Reads all registered Reservation Keys
01h	READ RESERVATION	Reads the current persistent reservations
02h-1fh	Reserved	Reserved

READ KEYS – The READ KEYS service action that the drive return a parameter list containing a header and a list of each current registered initiator's reservation key. If multiple initiators have registered with the same key, then that key value shall be listed multiple times, once for each such registration.

READ RESERVATIONS – The READ RESERVATIONS service action requests that the drive return a parameter list containing a header and the persistent reservation(s), if any, that is present in the drive. Multiple persistent reservations may be returned only if element reservations are present.

Allocation Length: The Allocation Length field indicates how much space has been reserved for the returned parameter list. If length is not sufficient to contain the entire parameter list, the first portion of the list shall be returned. This shall not be considered an error. If the remainder of the list is required, the application client should send a new PERSISTENT RESERV IN command with a Allocation Length field large enough to contain the entire list.

The returned the parameter data provided in response to a PERSISTENT RESERVE IN command with the READ KEYS service action has the following format:

Table 6-55: PERSISTENT RESERVATION IN parameter data for READ KEYS

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)			GENERATION				
3								(LSB)
4	(MSB)			Additional Length				
7								(LSB)
	Reservation Key list							
8	(MSB)			First reservation key				
15								(LSB)
n-7	(MSB)			Last reservation key				
n								(LSB)

GENERATION: This field shall contain a 32-bit counter maintained by the drive that shall be incremented every time a PERSISTENT RESERVE OUT command requests a REGISTER, a CLEAR, a PREEMPT, or a PREEMPT AND ABORT service action. The counter shall not be incremented by a PERSISTENT RESERVE IN command, by a PERSISTENT RESERVE OUT command that performs a RESERVE or RELEASE service action, or by a PERSISTENT RESERVE OUT command that is not performed due to an error or reservation conflict. The generation value shall be set to 0 as part of the power on reset process.

Additional Length: This filed contains a counter of the number of bytes in the Reservation key list. If the allocation length specified by the PERSISTENT RESERVE IN command is not sufficient to contain the entire parameter list, then only the bytes from 0 to the maximum allowed allocation length shall be sent to the application client. The incremental remaining bytes shall be truncated, although the Additional Length field shall still contain the actual number of bytes in the reservation key list without consideration of any truncation resulting from an insufficient allocation length. This shall not be considered an error.

Reservation Key: The reservation key list contains the 8-byte reservation keys for all initiators that have registered through all ports with drive.

The returned the parameter data provided in response to a PERSISTENT RESERVE IN command with the READ RESERVATION service action has the following format:

Table 6-56: PERSISTENT RESERVATION IN parameter data for READ RESERVATION

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)	GENERATION						
3								(LSB)
4	(MSB)	Additional Length						
7								(LSB)
8	(MSB)	Reservation descriptor						
23								(LSB)

GENERATION: This field shall be defined for the PERSISTENT RESERVE IN READ KEYS parameter data.

Additional Length: This filed contains a counter of the number of bytes to follow in Reservation descriptor. If the allocation length specified by the PERSISTENT RESERVE IN command is not sufficient to contain the entire parameter list, then only the bytes from 0 to the maximum allowed allocation length shall be sent to the application client. The incremental remaining bytes shall be truncated, although the Additional Length field shall still contain the actual number of bytes of Reservation descriptor and shall not be affected by the truncation. This shall not be considered an error.

Reservation descriptor: The format of this field is defined in table 6-57.

Table 6-57: PERSISTENT RESERVATION IN Reservation Descriptor

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)	Reservation Key						
7								(LSB)
8	(MSB)	SCOPE-SPECIFIC Address						
11		(0 0 0 0)						(LSB)
12	Reserved							
13	SCOPE				TYPE			
14	Obsolete							
15								

The Reservation descriptor for each reservation shall contain the Reservation Key under which the persistent reservation is held. The TYPE and SCOPE of each persistent reservation as present in the PERSISTENT RESERVE OUT command that created the persistent reservation shall be returned.

SCOPE-SPECIFIC Address: The drive does not support an Element reservation. This field shall be set to zero.

SCOPE: The value in this field indicates whether a persistent reservation applies to an entire logical unit to an element. The value in this filed are defined in table 6-58.

Table 6-58: PERSISTENT RESERVATION SCOPE Codes

Code	Name	Description
0h	Logical Unit	Persistent reservation applies to the full logical unit
1h		Obsolete
2h	Element (not supported in this drive)	Persistent reservation applies to the specified element
3h-fh	Reserved	Reserved

Logical Unit: A SCOPE value of Logical Unit indicates that the persistent reservation applies to the entire logical unit. The Logical Unit scope shall be implemented by all device servers that implement PERSISTENT RESERVE OUT.

Element: A SCOPE filed value of Element indicates that the persistent reservation applies to the element of the logical unit defined by the SCOPE-SPECIFIC Address field in the PERSISTENT RESERVE OUT parameter list.

The drive do not support it.

TYPE: The value in the TYPE filed specify the characteristics of the persistent reservation being established for all data blocks within the element or within the logical unit. Table 6-59 defines the characteristic of the different type values. For each persistent reservation type, table 6-59 lists code value and describes the required device server support. In this table, the description of required device server support is divided in two paragraphs. The first paragraph defines the required handling for read operations. The second paragraph defines the required handling for write operations.

Table 6-59: PERSISTENT RESERVATION TYPE Codes

Code	Name	Description
0h		Obsolete
1h	Write Exclusive	Reads Shared: Any application client on any initiator may execute tasks that request transfers from the storage medium or cache of the logical unit to the initiator. Writes Exclusive: Any task from any initiator other than the initiator holding the persistent reservation that requests a transfer from the initiator to the storage medium or cache of the logical unit shall result in a reservation conflict.
2h		Obsolete
3h	Exclusive Access	Reads Exclusive: Any task from any initiator other than the initiator holding the persistent reservation that requests a transfer from the storage medium or cache of the logical unit shall result in a reservation conflict. Write Exclusive: Any task from any initiator other than the initiator holding the persistent reservation that requests a transfer from the initiator to the storage medium or cache of the logical unit shall result in a reservation conflict.
4h		Obsolete
5h	Write Exclusive-Registrants Only	Reads Shared: Any application client on any initiator may execute tasks that request transfers from the storage medium or cache of the logical unit to the initiator. Writes Exclusive: Any task from any initiator other than the initiator holding the persistent reservation that requests a transfer from the initiator to the storage medium or cache of the logical unit shall result in a reservation conflict.
6h	Exclusive Access-Registrants Only (not supported in this drive)	Reads Exclusive: A task that requests a transfer from the storage medium or cache of the logical unit to an initiator that has not previously requested a REGISTER service action with the drive shall result in a reservation conflict. Write Exclusive: Any task from any initiator other than the initiator holding the persistent reservation that requests a transfer from the initiator to the storage medium or cache of the logical unit shall result in a reservation conflict.
7h-Fh	Reserved	

6.10. PERSISTENT RESERVE OUT 5Fh

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (5Fh)							
1	Reserved			SERVICE ACTION				
2	SCOPE				TYPE			
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	(MSB)	Parameter List Length (18h)						
8								(LSB)
9	Unused (00b)		Reserved				Flag	Link

The PERSISTENT RESERVE OUT command is used to request service actions that reserve a logical unit or element for the exclusive or shared used if a particular initiator. The command uses other service actions to manage and remove such reservations. The command shall be used in conjunction with the PERSISTENT RESERVE IN command and shall not be used with the RESERVE and RELEASE commands.

Initiator performing PERSISTENT RESERVE OUT service actions are identified by a reservation key provided by the application client. An application client may use the PERSISTENT RESERVE IN command to identify which initiators are holding a persistent reservation and use the PERSISTENT RESERVE OUT command to preempt that reservation if required.

If a PERSISTENT RESERVE OUT command is attempted, but there are insufficient drive resources to complete the operation, the drive shall return a CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense data shall be set to INSUFFICIENT REGISTRATION RESOURCES.

The PERSISTENT RESERVE OUT command contains fields that specify a persistent reservation service action, the intended scope of the persistent reservation, and the restrictions caused by the persistent reservation. The TYPE and SCOPE fields are define in 6.9. If a SCOPE filed specifies a scope that is not implemented, the drive shall return a CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and additional sense data shall be set to INVALID FIELD IN CDB.

Fields contained in the PERSISTENT RESERVE OUT parameter list specify the information required to perform a particular persistent reservation service action.

The parameter list shall be 24 bytes in length and the Parameter List Length field shall contain 24(18h). If the parameter list length is not 24, the drive shall return a CHECK CONDITION status. The sense key shall be set to ILLGAL REQUEST and the additional sense data shall be set to PARAMETER LIST LENGTH ERROR.

SERVICE ACTION: When processing the PERSISTENT RESERVE OUT service actions, the drive shall increment the generation value as specified in 6.9.

Table 6-60: PERSISTENT RESERVE OUT SERVICE ACTION codes

Code	Name	Description
00h	REGISTER	Register a reservation key with the drive
01h	RESERVE	Create a persistent reservation having a specified SCOPE and TYPE. The SCOPE and TYPE of a persistent reservation are defined in 6.9
02h	RELEASE	Releases the selected reservation for the requesting initiator.
03h	CLEAR	Clears all reservation keys and all persistent reservations.
04h	PREEMPT	Preempts persistent reservations from another initiator.
05h	PREEMPT & ABORT	Preempts persistent reservations from another initiator and aborts the task set for the preempted initiator.
06h-1Fh	Reserved	

The parameter list required to perform the PERSISTENT RESERVE OUT command has the following format:

Table 6-61: PERSISTENT RESERVE OUT parameter list

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)			Reservation Key				
7								(LSB)
8	(MSB)			SERVICE ACTION Reservation Key				
15								(LSB)
16	(MSB)			SCOPE-SPECIFIC Address				
19				(0 0 0 0)				(LSB)
20	Reserved							APTPL
21	Reserved							
22				Obsolete				
23								

Reservation Key: This field contains an 8-byte value provided by the application client to the drive to identify the initiator that is the source of the PERSISTENT RESERVE OUT command. The drive shall verify that the Reservation Key field in a PERSISTENT RESERVE OUT command matches the registered reservation key for the initiator from which the task was received, except for the REGISTER service action for an unregistered initiator which shall have a reservation key value of zero. If a PERSISTENT RESERVE OUT command specifies a Reservation Key field other than the reservation key registered for the initiator, the drive shall return a RESERVATION CONFLICT status. The reservation key of the initiator shall be verified to be correct regardless of the SERVICE ACTION and SCOPE field values.

SERVICE ACTION Reservation Key: This field contains information needed for three service actions; the REGISTER, PREEMPT, and PREEMPT AND ABORT service actions. For the REGISTER service action, the SERVICE ACTION Reservation Key field contains the new reservation key to be registered. For the PREEMPT and PREEMPT AND ABORT service actions, the SERVICE ACTION Reservation Key field contains the reservation key of the persistent reservations that are being preempted. The SERVICE ACTION Reservation Key field is ignored for all other service actions.

SCOPE-SPECIFIC Address: The drive do not support an Element reservation, then this field shall be set to zero.

APTPL: The Activate Persistent Through Power Loss(APTPL) bit is not supported by the drive. If this bit is set a CHECK CONDITION status is returned with an INVALID FIELD IN PARAMETER LIST.

The loss of power in the target shall release the persistent reservation for all logical units and remove all reservation keys.

Table 6-62 summarizes which field are set by the application client and interpreted by the drive for each service action and scope value.

Table 6-62: PERSISTENT RESERVE OUT service actions and valid parameters

Service Action	Allowed Scope	Parameters		
		TYPE	SERVICE ACTION RESERVATION KEY	SCOPE- SPECIFIC Address
REGISTER	ignored	Ignored	Valid	Ignored
RESERVE	Logical Unit	Valid	Ignored	Ignored
RELEASE	Logical Unit	Valid	Ignored	Ignored
CLEAR	Ignored	Ignored	Ignored	Ignored
PREEMPT	Logical Unit	Valid	Valid	Ignored
PREEMPT & CLEAR	Logical Unit	Valid	Valid	Ignored

6.11. PREVENT ALLOW MEDIUM REMOVAL 1Eh

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Eh)							
1	Obsolete			Reserved				
2	Reserved							
3	Reserved							
4	Reserved							Prevent
5	Control							

The PREVENT ALLOW MEDIUM REMOVAL command requests that the target enable or disable the removal of the medium in the drive. This mechanism is independent of device reservations and the drive shall not allow medium removal if any initiator currently has medium removal prevented.

The prevention of medium removal shall begin when any initiator issues a PREVENT ALLOW MEDIUM REMOVAL command with a prevent bit of one (medium removal prevented). The prevention of medium removal for the logical unit shall terminate:

1. Upon a hard RESET condition.
2. Upon the receipt of a BUS DEVICE RESET message from any initiator
3. After all initiators that have medium removal prevented issue PREVENT ALLOW MEDIUM REMOVAL commands with a prevent bit of ZERO, and the target has successfully performed a synchronize cache operation.

While a prevention of medium removal condition is in effect the target shall inhibit mechanisms that normally allow removal of the medium by an operator.

Prevent: When this bit is set, the drive will not eject the tape following an UNLOAD. When it receives the UNLOAD, the drive writes any buffered data to tape, rewind, then unthreads the tape from the mechanism. The drive does not eject the tape. Setting this bit also completely disables the Eject button on the front panel (except emergency eject). This situation remains until the Prevent bit is set to ZERO.

When this bit is set to ZERO, the drive ejects the cassette following completion of an UNLOAD. The Eject button is also re-enabled.

6.12. READ 08h

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (08h)							
1	Obsolete			Reserved			SILI	Fixed
2	(MSB)							
3				Transfer Length				
4								(LSB)
5	Control							

READ transfers one or more data blocks to the initiator starting with the next block on the drive.

Fixed: This bit specifies the meaning of the Transfer Length field and whether fixed-length or variable-length blocks are to be transferred.

If the Fixed bit is set to ZERO, Variable Block mode is requested. A single block is transferred with the Transfer Length specifying the maximum number of bytes the Host has allocated for the returned data.

If the Fixed bit is set to one, the Transfer Length specifies the number of blocks to be transferred to the Host. This is valid only if the drive is currently operating in Fixed Block mode, in other words, when it has been instructed to use fixed-length blocks with MODE SELECT command. If the Fixed bit is set and the drive is in Variable Block mode, the READ is rejected with a CHECK CONDITION status and an ILLEGAL REQUEST sense key set.

When the Transfer Length is ZERO, no data will be transferred and the current position on the logical unit will not be changed.

A successful READ command with the Fixed bit set transfers (current Block Length) X (Transfer Length) bytes of data to the Host. Upon termination of the READ command, the media will be logically positioned after the last block transferred (EOM side).

SILI: A Suppress Incorrect Length Indicator bit of one indicates that the device will not return CHECK CONDITION status if the only error is that the Transfer Length is not equal to the actual Block Length recorded on the media. Note, however, that if the SILI bit is one and the Fixed bit is ZERO, then the device will report CHECK CONDITION, if the requested Transfer Length is less than the actual block size recorded on the medium (over-length condition) AND the device is configured to be in Fixed Block mode (i.e. the Block Length field in the MODE SELECT/SENSE block descriptor is non-ZERO).

If the SILI bit is one and the Fixed bit is one, the drive will terminate the command with a CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code to ILLEGAL FIELD IN CDB. If the SILI bit is not set and the actual Block Length is different from the specified transfer length, a CHECK CONDITION status is returned. Within the Sense data, the Incorrect Length Indicator (ILI) bit and Valid bit will be set to one, the Sense Key field is set to NO SENSE and the Information Bytes are to set the difference (residue) between the requested Transfer Length and the actual Block Length, or in Fixed Block mode, the difference (residue) between the requested number of blocks and the actual number of blocks read. No more than Transfer Length bytes are transferred to the initiator and the tape is logically positioned after the last block transferred (EOM side).

If the drive reads a File-mark, the drive will return a CHECK CONDITION status. Within the Sense data, the File-mark and Valid bits are set and the Sense Key field is set to NO SENSE. The information fields contain the residue count. The Additional Sense Code and Additional Sense Code Qualifier fields are set to File-mark Detected. Upon termination, the media will be logically positioned after the File-mark (EOM side).

If, however, the drive encounters a Save-Set Mark during a READ, nothing is reported unless the drive has been configured through MODE SELECT to Report Save-Set Marks. The drive will ignore the Set-mark and continue the READ. If the Report Save-Set Marks configuration is enabled then the File-mark and Valid bits are set and the Sense Key field is set to NO SENSE. The information fields contain the residue count and the Additional Sense Code and Additional Sense Code Qualifier fields are set to Set-mark Detected. The tape is logically positioned after the Save-Set Mark (EOM side).

If the drive detects EOD during the READ, the drive will return a CHECK CONDITION status. Within the Sense data, the Valid bit is set and the Sense Key field is set to BLANK CHECK. The information fields contain the residue count. The Additional Sense Code and Additional Sense Code Qualifier fields are set to EOD DETECTED. Upon termination, the media will be physically positioned before EOD and after the last block on tape.

The meaning of EOM is different for READ than for a WRITE type of command. EOM is only reported when the physical EOM/P is encountered. The drive returns a CHECK CONDITION status. The EOM and Valid bits are set and the Information fields contain the residue count. If EOD is not written after the physical EOM/P, the Sense Key is set to MEDIUM ERROR and the Additional Sense Code and Additional Sense Code Qualifier fields are set to EOM/P Detected. If EOD is written, the Sense Key is set to BLANK CHECK and the Additional Sense Code and Additional Sense Code Qualifier fields are set to END-OF-DATA DETECTED. The tape is physically positioned at EOM/P.

For a File-mark, a (reported) Save-Set Mark, EOD or EOM detected, if the Fixed bit is set, the Information field in the REQUEST SENSE Data will be set to the difference (residue) between the requested Transfer Length and the actual number of blocks read (not including the File-mark or Save-Set Mark). If the Fixed bit is set to ZERO, the information bytes will be set the requested Transfer Length because File-marks and Save-Set Marks are considered to have a byte count of ZERO, (though this does not cause the ILI bit to be set).

READ may return the following sense keys on a CHECK CONDITION:

NO SENSE: If the actual Block Length is different from the specified Transfer Length and the SILI bit is ZERO, the ILI (Incorrect Length Indicator) bit and Valid bit are set to one. The Information bytes in extended sense are set to the difference (residue) between the requested Transfer Length and the actual Block Length, or in Fixed Block mode, the difference (residue) between the requested number of blocks and the actual number of blocks read (not including the incorrect length block). No more than Transfer Length bytes are transferred to the initiator and the tape is logically positioned after the block (EOM side).

If the drive reads a File-mark during this command, it sets the File-mark bit in the REQUEST SENSE data. Upon termination, the tape is logically positioned after the File-mark (EOM side). If, however, the drive encounters a Save-Set Mark during this command, nothing is reported unless the SDX-900V has been configured through MODE SELECT to Report Save Set Marks. If the Report Save Set Marks configuration is enabled then the Valid bit and the Additional Sense Key flags are set in the REQUEST SENSE data to indicate that a Save-Set Mark has been encountered. The tape is also logically positioned after the Save-Set Mark (EOM side).

For both a File-mark and a reported Save-Set Mark, if the Fixed bit is one, the Information bytes in the REQUEST SENSE data are set to the difference residue between the requested Transfer Length and the actual number of blocks read (not including the File-mark or Save-Set Mark).

If the Fixed bit is set to ZERO, the Information bytes are set to the difference (residue) between the requested Transfer Length and the actual number of bytes read. File-marks and Save-Set Marks are considered to have a byte count of ZERO, though this does not cause the ILI bit to be set.

MEDIUM ERROR: The current block being read or a previously acknowledged WRITE type of operation experienced an error probably related to the condition of the tape.

HARDWARE ERROR: Either a previously acknowledged WRITE type of operation had a major non-media related failure or the read itself experienced the failure. The Valid bit is set, and the Information field contains the appropriate residue. The meaning of EOM is different in a READ command from that in a WRITE type of command. EOM is only reported on physical end-of-media. However, this condition is indistinguishable from other fatal servo errors and so is reported as a HARDWARE ERROR.

BLANK CHECK: If EOD (End-of-Data) was encountered during a read, the sense key is BLANK CHECK, the Valid bit is set and the Information bytes contain the residue count.

6.13. READ ATTRIBUTE 8Ch

The READ ATTRIBUTE command allows an application client to read attribute values from the Medium Auxiliary memory (MAM).

Table 6-63: READ ATTRIBUTE command

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (8Ch)							
1	Reserved (0)			Service Action				
2	Reserved							
3	Reserved							
4	Reserved							
5	Volume Number							
6	Reserved							
7	Partition Number							
8	(MSB)			First Attribute ID				
9								(LSB)
10	(MSB)			Allocation Length				
11								
12								
13								(LSB)
14	Reserved							
15	Control							

If the medium auxiliary memory is not accessible because there is no medium present, the READ ATTRIBUTE command shall be terminated with a CHECK CONDITION status. The sense key shall be set to NOT READY and the additional sense code shall be set to MEDIUM NOT PRESENT.

If although medium is present, the Medium Auxiliary Memory is not accessible, the READ ATTRIBUTE command shall be terminated with a CHECK CONDITION status. The sense key shall be set to MEDIUM ERROR and the additional sense code shall be set to AUXILIARY MEMORY NOT ACCESSIBLE.

The service actions defined for the READ ATTRIBUTE command are shown in Table 6-63.

Table 6-64: READ ATTRIBUTE service action codes

Code	Name	Description
00h	Attribute Values	Return attribute values.
01h	Attribute List	Returns a list of available attribute identifiers, identifiers that are not in the nonexistent or unsupported state.
02h	Volume List	Return a list of known Volume Numbers.
03h	Partition List	Return a list of known Partition Numbers.
04h	Reserved for SMC-2	
05h – 1Fh	Reserved	

The VOLUME NUMBER specifies a volume within the Medium Auxiliary Memory. The number of volumes of the MAM shall equal that of the attached multi-volume medium. If the medium only has a single volume, then its volume number shall be zero.

The PARTITION NUMBER specifies a partition within a volume. The number of partitions of the MAM shall equal that of the attached multi-partition medium. If the medium only has a single partition, then its partition number shall be zero.

If the combination of VOLUME NUMBER and PARTITION NUMBER is not valid, the command shall be terminated with CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST, and the additional sense data shall be set to INVALID FIELD IN CDB.

The FIRST ATTRIBUTE IDENTIFIER field specifies the attribute identifier of the first attribute to be returned. If the specified attribute identifier is in the unsupported or nonexistent state, the READ ATTRIBUTE shall be terminated with a CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST, and the additional sense data shall be set to INVALID FIELD IN CDB.

The ALLOCATION LENGTH field specifies how many bytes have been allocated of the first attribute to be returned. If the length is not sufficient to contain the entire parameter list, the first portion of the list shall be returned. This shall not be considered an error. If the remainder of the list is required, the application client should either send a new READ ATRRIBUTE command with an ALLOCATION LENGTH field large enough to contain the entire parameter list or use the FIRST ATTRIBUTE IDENTIFIER field to restrict the attributes returned.

The format of parameter data returned by the READ ATTRIBUTE command depends on the service action specified.

6.13.1. ATTRIBUTE VALUES service action

The READ ATTRIBUTE command with ATTRIBUTE VALUES service action returns parameter data containing the attributes specified by the PARTION NUMBER, VOLUME NUMBER, and FIRST ATTRIBUTE INDENTIFIER fields in the CDB. The returned parameter data shall contain the requested attributes in ascending numerical order by attribute identifier value and in the format shown in table 6-65.

Table 6-65:

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)							
3	AVAILABLE DATA (n-3)							(LSB)
4 .. x	ATTRIBUTE 0							
..								
m .. n	ATTRIBUTE x							

The AVAILABLE DATA field shall contain the number of bytes of attribute information in the parameter list. If the parameter list is truncated as a result of insufficient allocation length, the contents of the AVAILABLE DATA field shall not be altered.

6.13.2. ATTRIBUTE LIST service action

The READ ATTRIBUTE command with ATTRIBUTE LIST service action returns parameter data containing the attribute identifiers for the attributes that are not in the unsupported state and not in the nonexistent state in the specified partition and volume number. The contents of FIRST ATTRIBUTE IDENTIIER field in the CDB shall be ignored. The returned parameter data shall contain the requested attribute identifiers in ascending numerical order by attribute identifier value and the format shown in table 6-66.

Table 6-66: READ ATTRIBUTE with ATTRIBUTE LIST service action parameters list format.

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)							
3	AVAILABLE DATA (n-3)							(LSB)
4	(MSB)							
5	ATTRIBUTE 0							(LSB)
...								
n-1	(MSB)							
n	ATTRIBUTE x							(LSB)

The AVAILABLE DATA field shall contain the number of bytes of attribute in the parameter list. If the parameter list is truncated as a result of insufficient allocation length, the contents of the AVAILABLE DATA field shall not be altered.

An ATTRIBUTE IDENTIFIER field is returned for each attribute that is not in the unsupported state and not in the nonexistent state in specified partition and volume number.

6.13.3. PARTITION LIST service action

The READ ATTRIBUTE command with PARTITION LIST service action returns parameter data (table 6-67) identifying the number of partitions supported in the specified volume number. The contents of PARTITION NUMBER and FIRST ATTRIBUTE IDENTIFER fields in the CDB shall be ignored.

TABLE 6-67: READ ATTRIBUTE WITH VOLUME LIST SERVICE ACTION PARAMETER LIST FORMAT.

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)			AVAILABLE DATA (2)				
1								(LSB)
4	FIRST PARTITION NUMBER							
5	NUMBER OF PARTITIONS AVAILABLE							

The AVAIABLE DATA field shall contain two.

The FIRST PARTITION NUMBER field indicates the first partition available on the specified volume number. Partition numbering should start at zero.

The NUMBER OF PARTITIONS AVAILABLE indicates the number of Partitions available on the specified VOLUME NUMBER.

6.13.4. VOLUME LIST service action

The READ ATTRIBUTE command with VOLUME LIST service action returns parameter data (table 6-68) identifying the supported number of volumes. The contents of VOLUME NUMBER, PARTITION NUMBER, and FIRST ATTRIBUTE IDENTIFIER fields in the CDB shall be ignored.

Table 6-68: READ ATTRIBUTE with VOLUME LIST service action parameter list format.

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)			AVAILABLE DATA (2h)				
1								(LSB)
2	FIRST VOLUME NUMBER							
3	NUMBER OF VOLUMES AVAILABLE							

The AVAILABLE DATA field shall contain two.

The FIRST VOLUME NUMBER field indicates the first volume available. Volume numbering should start at zero.

The NUMBER OF VOLUMES AVAILABLE field indicates the number of volumes available.

6.14. READ BLOCK LIMITS 05h

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (05h)							
1	Obsolete			Reserved				
2	Reserved							
3	Reserved							
4	Reserved							
5	Control							

The READ BLOCK LIMITS command tells the drive to return its limits for Block Length. The READ BLOCK LIMITS data shown below will be sent during the DATA IN phase of the command. The command does not reflect the currently selected block size, only the available limits. MODE SENSE returns the current block size. 2 bytes is the minimum and 8 Mbytes - 1 byte is the maximum block size which the unit can support.

Table 6-69: READ BLOCK LIMITS Data

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved			Granularity(02h)				
1	(MSB)	Maximum Block Length Limit (FF FF FCh)						
2								
3								(LSB)
4	(MSB)	Minimum Block Length Limit (00 04h)						
5								(LSB)

GRANULARITY: This field indicates the block size granularity of the Logical Unit and the recording format. For this Logical Unit, the value is 2, indicating a granularity of 2**GRANULARITY.

The maximum block length limit and minimum block length limit field values are shown in Table 6-69.

6.15. READ BUFFER 3Ch

Bit / Bite	7	6	5	4	3	2	1	0
0	Operation Code (3Ch)							
1	Obsolete			Reserved	Mode			
2	Buffer ID							
3	(MSB)	Buffer Offset						
4								
5								(LSB)
6	(MSB)	Allocation Length						
7								
8								(LSB)
9	Control							

READ BUFFER is used in conjunction with WRITE BUFFER as a diagnostic function for testing the data buffer and the SCSI bus integrity of the drive. A REWIND command should be sent to the drive after WRITE/READ BUFFER diagnostic testing to return to normal operation.

Note: This command may not be used to recover data that is buffered within the drive. If the drive receives a READ BUFFER without having had a prior WRITE BUFFER command, only the four byte header will be returned. There is no available data to return, as the drive writes any buffered data to tape prior to accepting either a READ BUFFER or WRITE BUFFER for the first time.

Mode: The drive supports the following values within this field. If any other value is set, the drive will terminate the command with a CHECK CONDITION status and an ILLEGAL REQUEST sense key set.

Table 6-70: READ BUFFER Mode values

Mode	Description
0000b	Combined Header and Data
0010b	Data
0011b	Descriptor
1010b	Echo Buffer
1011b	Echo Buffer Descriptor

Combined Header and Data Mode-in this mode, the drive returns a four-byte header followed by the data bytes. The drive terminates the DATA IN phase when Allocation Length bytes of header plus data have been transferred or when the header and all available data have been transferred to the initiator, whichever is less. The four-byte READ BUFFER header is followed by data bytes from the drive's data buffer.

Table 6-71: READ BUFFER Header

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved							
1	(MSB)	Available Length						
2								
3								(LSB)

Available Length: specifies the total number of data bytes that are available in the target's data buffer. This number is not reduced to reflect the Allocation Length nor is it reduced to reflect the actual number of bytes written using the WRITE BUFFER command. Following the READ BUFFER header, the target will transfer data from its data buffer.

Data Mode - in this mode, the DATA IN phase contains buffer data only.

Descriptor Mode - In this mode, a maximum of four bytes of READ BUFFER descriptor information is returned. The device server shall return the descriptor information for the buffer specified by the BUFFER ID field (see the description of the buffer ID). If there is no buffer associated with the specified buffer ID, the device server shall return all zeros in the READ BUFFER descriptor. The BUFFER OFFSET field is reserved in this mode. The allocation length should be set to four or greater. The device server shall transfer the lesser of the allocation length or four bytes of READ BUFFER descriptor.

Table 6-72: READ BUFFER Descriptor

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved							
1	(MSB)							
2				Buffer Capacity				
3								(LSB)

Buffer ID: The supported values are:

Table 6-73:

Buffer ID	Description	Offset
0	Read Group Buffer	0 - 0x01000000
80	Read Group Buffer	0 - 0x01000000
81	Read Group Buffer	0x01000000 - 0x02000000
82	Read Group Buffer	0x02000000 - 0x03000000
83	Read Group Buffer	0x03000000 - 0x04000000

If an unsupported Buffer ID code is requested, the drive returns a CHECK CONDITION status with an ILLEGAL REQUEST sense key set.

Buffer Offset: The Buffer Offset field contains the byte offset within the specified buffer from which data shall be transferred from. The initiator should conform to the offset boundary requirements returned in the READ BUFFER descriptor. If the target is unable to accept the specified buffer offset, it shall return CHECK CONDITION status, shall set the Sense Key to ILLEGAL REQUEST, and set the Additional Sense Code to ILLEGAL FIELD IN CDB.

Allocation Length: The Allocation Length specifies the maximum number of bytes that the initiator has allocated for returned data. An Allocation Length of ZERO indicates that no data will be transferred. Any other value indicates the maximum number of bytes that will be transferred. The drive terminates the DATA IN phase when Allocation Length bytes of data have been transferred or when all available data has been transferred to the initiator, whichever is less. The Allocation Length must be greater than four (except in data only mode), else the drive will return a CHECK CONDITION status with an ILLEGAL REQUEST sense key set.

Read Data from Echo Buffer: Domain Validation is an important feature introduced in Ultra160 SCSI. It provides a mechanism for SCSI devices to perform at maximum possible operational data transfer speed. Domain validation performs a quick test to help ensure an initiator and target can actually transfer data at negotiated speeds. Using Echo Buffer option, the initiator can do a more extensive data transfer validation test. The initiator transmits the data using the WRITE BUFFER command with the echo buffer option and requests it back using the READ BUFFER command with echo buffer option.

Echo Buffer (1010b): In this mode the drive transfer data to the application client from the echo buffer. The echo buffer shall transfer the same data as when the WRITE BUFFER command with the mode field set to echo buffer was issued. The BUFFER ID and BUFFER OFFSET fields are ignored in this mode. The READ BUFFER command shall return the same number of bytes of data as received in the prior echo buffer mode WRITE BUFFER command from the same initiator.

The initiator may send a READ BUFFER command requesting the echo buffer descriptor prior to a WRITE BUFFER command. If an echo buffer mode WRITE BUFFER command is successful then the initiator may send multiple echo buffer mode READ BUFFER commands to read the echo buffer data multiple times.

Echo buffer descriptor (1011b): In this mode, a maximum of four bytes of READ BUFFER descriptor information is returned. The drive will return the descriptor information for the echo buffer. The BUFFER OFFSET field is reserved in this mode. The allocation length should be set to four or greater.

Table 6-74: Echo Buffer descriptor

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved							EBOS (1)
1	Reserved							
2	Reserved				(MSB)			
3	BUFFER CAPACITY							(LSB)

The BUFFER CAPACITY field will return the size of the echo buffer in bytes aligned to a four-byte boundary. The maximum echo buffer size is 4096 bytes. The drive will maintain separate echo buffer for each different initiator and will ensure echo buffer data from each initiator is the same as that previously written by the same initiator.

6.16. READ POSITION 34h

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (34h)							
1	Obsolete			Reserved		TCLP	LONG	BT
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	Reserved							
8	Reserved							
9	Control							

The READ POSITION command reports the current position of the logical unit. No medium movement shall occur as a result of the command. The position is given in two parts:

TCLP: The Total Current Logical Position (TCLP) bit of ONE indicates the drive shall return data specifying the partition, file, and set number with the current logical position. The TCLP bit of ZERO indicates the drive shall return data specifying the first and last block location with the number of bytes and blocks in buffer.

LONG: The Long Format (LONG) bit of ONE indicates the drive shall return 32 bytes of data. The LONG bit of ZERO indicates the drive shall return 20 bytes of data.

The LONG bit and the TCLP bit shall be equal. If the LONG and TCLP bits are not equal, or if both the LONG and the Block Address Type (BT) bits are ONE, the command is rejected with a CHECK CONDITION status and an ILLEGAL REQUEST sense key set.

BT: The Block Address type (BT) bit controls the content of the short format data. The BT bit if one requests the drive to return its current First Block Location shall include data block only. The BT bit of ZERO requests the drive to return the First Block Location are a SCSI Logical Block Address (data blocks, File-marks and Save Set Marks are counted.)

Table 6-75: READ POSITION Data Format, short form

Bit / Byte	7	6	5	4	3	2	1	0
0	BOP	EOP	Reserved			BPU	Reserved	
1	Partition Number							
2	Reserved							
3	Reserved							
4	(MSB)	First Block Location						
7								(LSB)
8	(MSB)	Last Block Location						
11								(LSB)
12	Reserved							
13	(MSB)	Number of Blocks in Buffer						
15								(LSB)
16	(MSB)	Number of Bytes in Buffer (00 00 00 00h)						
19								(LSB)

BOP: A Beginning Of Partition (BOP) bit of one indicates that the logical unit is at the beginning-of-partition in the current partition. A BOP bit of ZERO indicates that the current logical position is not at the beginning-of-partition.

EOP: An End Of Partition (EOP) bit of one indicates that the logical unit is positioned between early-warning and end-of-partition in the current partition. An EOP bit of ZERO indicates that the current logical position is not between early-warning and end-of-partition. Note that this bit is mutually exclusive with the BOP bit.

BPU: A Block Position Unknown (BPU) bit of one indicates that the First and Last Block Locations are not known or cannot be obtained. A BPU bit of ZERO indicates that the First contains valid position information.

Partition Number: reports the current partition number for the current logical position.

First block location: indicates the Block Address associated with the current logical position. The value shall indicate the Block Address of the next data block to be transferred between the initiator and the target if a READ or WRITE command is issued. See BT field for description of Logical Block Address. Note that the Logical Block Address at BOT/P is 0.

Last block location: indicates the Block Address associated with the next block to be transferred from the buffer to the medium. The value shall indicate the Block Address of the next data block to be transferred between the buffer and the medium. If the buffer does not contain a whole block of data or is empty, the value reported for the last block location shall be equal to the value reported for the first block location.

Number of Blocks in Buffer: indicates the number of data blocks in the buffer of the logical unit that have not been written to the medium.

Number of Bytes in Buffer: This field is not supported and is always set to ZERO.

Table 6-76: READ POSITION Data Format, long form

Bit / Byte	7	6	5	4	3	2	1	0
0	BOP	EOP	Reserved		MPU	BPU	Reserved	
1	Reserved							
2	Reserved							
3	Reserved							
4	(MSB)	Partition Number						
7								(LSB)
8	(MSB)	Block Number						
15								(LSB)
16	(MSB)	File Number						
23								(LSB)
24	(MSB)	Set Number						
31								(LSB)

The BOP, EOP, and Partition Number are as defined in the READ POSITION data returned when the TCLP bit is set to 0.

BPU: The Block Position Unknown (BPU) bit of ONE indicates the partition number or block number are not know or accurate reporting is not currently available. The BPU bit of ZERO indicates the partition number and block number fields contain valid position information.

MPU: The Mark Position Unknown (MPU) bit of ONE indicates the file number and set number are not known or accurate reporting is not currently available. The MPU bit of ZERO indicates the File number and Set number fields contain valid position information.

Block Number: Block Number reports the number of logical blocks between beginning-of-partition and current logical position. Set-marks and File-marks count as one logical block each.

File Number: File Number reports the number of file-marks between beginning-of -partition and the current logical position.

Set Number: Set Number reports the number of set-marks between beginning –of-partition and the current logical position

.

6.17. RECEIVE DIAGNOSTIC RESULTS 1Ch

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Ch)							
1	Obsolete			Reserved				
2	Reserved							
3	(MSB)	Allocation Length						
4								(LSB)
5	Control							

RECEIVE DIAGNOSTIC RESULTS requests error analysis data be sent to the initiator after completion of a SEND DIAGNOSTIC command.

Allocation Length: This field specifies the number of bytes that the initiator has allocated for returned diagnostic data. An Allocation Length of ZERO means that no diagnostic data will be transferred. Any other value indicates the maximum number of bytes that will be transferred.

If the SEND DIAGNOSTIC had the PF bit set, the drive returns four bytes of header data as will as eight bytes of the diagnostic result. If the PF bit was not set, the drive returns only the eight bytes of the diagnostic result.

The drive terminates the DATA IN phase when Allocation Length bytes have been transferred or when all the available diagnostic data (four or eight bytes depending on the PF bit) have been transferred to the initiator, whichever, is less.

If the drive returns a CHECK CONDITION status with the HARDWARE ERROR Sense Key and an Additional Sense Code of DIAGNOSTIC FAILURE set on completion of a SEND DIAGNOSTIC, then the Host should issue a RECEIVE DIAGNOSTIC RESULTS command to receive the eight bytes of data indicating the actual failure and the Most Suspect Unit (MSU).

If the Host issued a SEND DIAGNOSTIC with the PF bit set and a page Code of ZERO, the drive returns which pages it supports in the following format:

Table 6-77: RECEIVE DIAGNOSTICS supported pages

Bit / Byte	7	6	5	4	3	2	1	0
0	Page Code (00h)							
1	Reserved							
2	(MSB)	Page Length (00 02h)						
3								(LSB)
4	Supported Page Code (00h)							
5	Supported Page Code (81h)							

If the Host issued a SEND DIAGNOSTIC with the PF bit set and a Page Code of 81h, the drive returns the following four bytes of page header, then five bytes of diagnostic results.

Table 6-78: RECEIVE DIAGNOSTICS page header

Bit / Byte	7	6	5	4	3	2	1	0
0	Page Code (81h)							
1	Reserved							
2	(MSB)	Page Length (00 05h)						
3								(LSB)

The structure of the diagnostic results data is described below:

All error messages are of the same format. All fields within the error message may not be known or applicable and are cleared to ZERO. A diagnostic result of all ZEROs is returned if the diagnostic completed successfully without error.

Table 6-79: RECEIVE DIAGNOSTICS results data

Bit / Byte	7	6	5	4	3	2	1	0
0	Reset Error	Time Re-Sync (0)	Reserved		Error Set			
1	Error Code							
2	Result A							
3	Result B							
4	Test Number							

Reset error: This bit is set when an error occurs during power-on self-test.

Time Re-Sync: This bit indicates that the time stamp saved with the error log has no relation to that of the previous entry. It is only set by the logging routine within the data buffer as an error is logged. This field is not supported.

Error set: Various set of error codes exist. The definition of the error is dependent upon when set is taken from as follows:

0 - Runtime errors
1 - Drive mechanism diagnostic errors
2 - Drive electronics diagnostic errors

Error code: Error codes for each error set are defined in the Diagnostics clause.

Result A and B: The content of these bytes depends on the test being run. See the Diagnostics clause.

Test number: This is the test number to which the message applies (if a test fails within a sequence, the individual test number will be returned).

6.18. RELEASE UNIT (6/10) 17h and 57h

Table 6-80: Release UNIT 6 CDB format

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (17h)							
1	Reserved			Obsolete				
2	Reserved							
3	Reserved							
4	Reserved							
5	Control							

Table 6-81:Release UNIT 10 CDB format

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (57h)							
1	Reserved			3rdPty	Reserved		LongID	Obsolete
2	Obsolete							
3	Third Party Device ID							
4	Reserved							
5	Reserved							
6	Reserved							
7-8	Parameter List Length							
9	Control							

RELEASE UNIT releases the drive if it was reserved by the requesting initiator using a RESERVE (6/10) command and is still in the reserved state. See PERSISTENT RESERVE OUT/IN for an alternate reservation system. This command cannot release a reservation generated by the PERSISTENT RESERVE OUT command.

Third party reservation management operations are only allowed using RESERVE (10) and RELEASE (10).

Logical Unit reservation management operations are allowed using RESERVE (6/10) and RELEASE (6/10).

3rdPty: The Third-Party release option for the RELEASE UNIT command allows an initiator to release a logical unit that was previously reserved using the Third-Party reservation option.

If the 3rdPty bit is ZERO, then the Third-Party release option is not requested. If the 3rdPty bit is one, then the drive is released, if the reservation was made using the Third-Party reservation option by the initiator that is requesting the release and for the same SCSI device as specified in the Third-Party Device ID field.

Obsolete: The Obsolete fields must be set to ZERO.

If the value in any Obsolete field is not ZERO, the command is terminated with CHECK CONDITION status and the Sense Key is set to ILLEGAL REQUEST. The Additional Sense Code is set to INVALID FIELD IN CDB.

3rd Party: Third Party Release allows an initiator to release a logical unit that was previously reserved for third party operations.

If the value in this field is 0b, a Logical Unit release is not requested.

If 3rdPty = 1b, the Logical Unit releases the specified logical unit, but only if the initiator, 3rdPty bit, and Third Party Device ID fields (in CDB or in Parameter List) are identical when compared to the values used in the RESERVE (10) command that established the reservation.

Long ID: If the Long ID bit is set to 1b and the Parameter List Length is 8, the parameter list contains the eight bytes of the device ID of the Third Party Device ID.

If the 3RDPTY bit is zero, the LONGID bit field is ignored.

This is required for Fiber Channel since each Device ID is at least three bytes long.

Third Party Device ID: If the Third Party Device ID value that is connected with the reservation release is equal to or smaller than 255, the LongID field may be 0b and the Third Party Device ID value is sent in this field.

The contents of the Third Party Device ID field in the CDB is ignored when LongID = 1b;

Note: If the Third Party Device ID value is greater than 255 (FFh), LongID must be set to 1b.

Parameter List Length: The contents of this field specify the length, in bytes, of the parameter list that will be transferred from the initiator to the Logical Unit.

If the 3RDPTY bit is zero, the PARAMETER LIST LENGTH field is ignored.

This field value must be 0000h when LongID = 0b. The field value must be 8 when LongID = 1b.

If LONG = 0b and Parameter List Length is not ZERO, the command is terminated with CHECK CONDITION status and the Sense Key is set to ILLEGAL REQUEST. The Additional Sense Code is set to INVALID FIELD IN CDB.

If LONG = 1b and Parameter List Length is not eight (8), the command is terminated with CHECK CONDITION status and the Sense Key is set to ILLEGAL REQUEST. The Additional Sense Code is set to INVALID FIELD IN CDB.

When the LongID bit = 1b, the parameter list has the format shown in Table 6-82.

Table 6-82: RELEASE (10) LongID Only Parameter List — Data Format

Bit Byte	7	6	5	4	3	2	1	0
0 - 7	(MSB) Third Party Device ID (LSB)							

6.19. REPORT DENSITY SUPPORT 44h

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (44h)							
1	Reserved							MEDIA
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	(MSB)	Allocation Length						
8								(LSB)
9	Control							

REPORT DENSITY SUPPORT provides information regarding the supported densities for the logical unit be sent to application client.

MEDIA : The MEDIA bit of ZERO indicates that the drive shall return density support data block for densities supported by the logical unit for any supported media. The data returned by the drive shall be static if the MEDIA bit is ZERO. The MEDIA bit of ONE indicates that the drive shall return density support data block for densities supported by the mounted medium. If the MEDIA bit is ONE and the logical unit is not in the ready state, CHECK CONDITION status shall be returned. The sense key shall be sent to NOT READY.

The Allocation Length field specifies the maximum number of bytes that the drive may return.

The REPORT DENSITY SUPPORT command returns the REPORT DENSITY SUPPORT header followed by one DENSITY SUPPORT data block. The Density support data blocks shall be in numerical ascending order of the primary density code value for each block.

Table 6-83: REPORT DENSITY SUPPORT header

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)	Available Density Support Length						
1								(LSB)
2	Reserved (00h)							
3	Reserved (00h)							

Available Density Support Length: This field specified the number of bytes in the following data that is available to be transferred. The Available density support length does not include itself.

Table 6-84: REPORT DENSITY SUPPORT data block descriptor

Bit / Byte	7	6	5	4	3	2	1	0
0	PRIMARY DENSITY CODE (33 h)							
1	SECONDARY DENSITY CODE (33 h)							
2	WRTOK (1)	DUP (0)	DEFLT (1)	Reserved (00h)				
3	Reserved (00h)							
4	Reserved (00h)							
5	(MSB)	BITS PER MM (00 17 D6 h)						
7								(LSB)
8	(MSB)	MEDIA WIDTH (00 50 h)						
9								(LSB)
10	(MSB)	TRACKS (00 01 h)						
11								(LSB)
12	(MSB)	CAPACITY						
15								(LSB)
16	(MSB)	ASSIGNING ORGANIZATION (SONY)						
23								(LSB)
24	(MSB)	DENSITY NAME (AIT-4)						
31								(LSB)
32	(MSB)	DESCRIPTION (Advanced Intelligent Tape-4)						
51								(LSB)

Density support data blocks shall be returned by ascending primary density code values.

Primary Density Code: This field contains the value returned by a Mode Sense command for the density described in the remainder of the density support block. The drive shall accept a Mode Select command containing this value, for appropriate media. The value of 00h shall only be used for the default of the logical unit.

WRTOK: The WRTOK bit of ZERO indicates that logical unit support for this density does not include writing to the media. The WRTOK bit of ONE indicates the logical unit is capable of writing this density to either the currently mounted medium (Media bit in CDB set to one) or for some media (Media bit in CDB set to Zero).

DUP: The DUP bit of ZERO indicates this primary density code has exactly support data block. The DUP bit of ONE indicates this primary density code is specified in more than on density support block.

DEFLT: The DEFLT bit of ZERO indicates this density in not the default density of the drive. The DEFLT of ONE indicates this density is the default density of the logical unit. If neither the Primary or Secondary density code is zero and the DEFLT bit is one, the logical unit shall accept a Mode Select density code of 00h as equivalent to the Primary and Secondary density code.

Bits Per MM: This field indicates the number of bits per millimeter per track as recorded on the medium. The value in this field shall be rounded up if the fractional value of the actual value is greater than or equal to 0.5. A value of 00h indicates that the number of bits per millimeter does not apply to this logical unit. Direct of this value between different suppliers (possible products) is discouraged since the definition of bits may vary.

Media Width: This field indicates the width of the medium supported by this density. This field has units of tenths of millimeters. The value in this field of equal to 0.5. The Media Width field may vary for a given density depending on the mounted medium. A value of 00h indicates that the width of the medium does not apply to this logical unit.

Tracks: This field indicates the number of data tracks supported on medium by this density.

Capacity: If MEDIA bit of CDB is set to 0, this field shall indicates the approximate capacity of the longest supported medium assuming recording in this density with one partition. If the Media bit of CDB is set to 0, set to 0m this field should indicate the approximate capacity of the current medium assuming recording in this density with one partition. If the approximate capacity of the current medium cannot be determined for the mounted medium, the longest supported medium capacity shall be used. The data and block size assumes that compression is disabled. The capacity also assumes that the media is in “good” condition, and that “normal” data and block size are used. This value is in units of megabytes (10000000 bytes). The logical unit does not guarantee that this space is actually available in all cases.

6.20. REPORT DEVICE IDENTIFIER A3h

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (A3h)							
1	Reserved			Service Action (05h)				
2 - 5	Reserved							
6 - 9	Allocation Length							
10	Reserved							
11	Control							

The REPORT DEVICE IDENTIFIER command requests that the Logical Unit send device identification information to the initiator.

Service Action: Must be 05h per SPC-2 standard.

For any value other than 05h, the command is terminated with CHECK CONDITION status, the sense key is set to ILLEGAL REQUEST, and the ASC/ASCQ is set to INVALID FIELD IN CDB.

Allocation Length: If the Allocation Length is not sufficient to allow all of the parameter data to be returned, the first portion of the data is returned (i.e., truncated). This is not considered an error.

Note: The actual length of the parameter data is calculated using the Identifier Length field in the parameter data plus 4.

Processing a REPORT DEVICE IDENTIFIER may require the enabling a nonvolatile memory within the logical unit. If the nonvolatile memory is not ready, the device server returns CHECK CONDITION status, rather than waiting for the device to become ready. The sense key is set to NOT READY and the additional sense code is set to reflect an appropriate reason for the NOT READY condition.

Note: This information should allow the initiator to determine the action required to cause the Logical Unit to become ready.

6-85: REPORT DEVICE IDENTIFIER - Data Format

Bit / Byte	7	6	5	4	3	2	1	0
0 - 3	Identifier Length (n – 3)							
4 - n	Identifier							

Identifier Length: Specifies the length in bytes of the Identifier field. If the Allocation Length field in the CDB is too small to transfer the header and all of the identifier, the length is not adjusted to reflect the truncation.

The identifier length is initially equal to zero, and is changed only by a successful SET DEVICE IDENTIFIER command.

Identifier: The value reported is the last value provided by a successful SET DEVICE IDENTIFIER command.

The value of the identifier is changed only by a successful SET DEVICE IDENTIFIER command.

The identifier value persists through resets, power cycles, media write operations, and media replacement.

If Identifier Length = 00000000h, this field is not present or has zero length.

6.21. REPORT LUNS A0h

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (A0h)							
1	Reserved							
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	(MSB)			Allocation Length				
7								
8								
9								(LSB)
10	Reserved							
11	Control							

The REPORT LUNS command requests that the peripheral device logical unit numbers of known logical units in the target be sent to the application client. The REPORT LUNS command shall return information about only those logical units to which commands may be sent.

The REPORT LUNS command shall not be affected by reservations or persistent reservations.

The Allocation length shall be at least 16 bytes. If the Allocation length is less than 16 bytes, the device server shall return CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense data shall be set to INVALID FIELD IN CDB.

The Allocation length is not sufficient to contain the logical unit number values for all configured logical units, the device server shall report as many logical unit number values as will fit in the specified Allocation length. This shall not be considered an error.

The device server shall report the logical unit numbers of configured original units using the format shown in table 6-86.

Table 6-86: LUN reporting parameter list format

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)			LUN List Length (00 00 00 08h)				
3								(LSB)
4				Reserved (0)				
7								
	LUN List							
8	(MSB)			LUN				
15								(LSB)

The LUN list length shall contain the length in bytes of the LUN list that is available to be transferred. The LUN list length is the number of logical unit numbers reported multiplied by eight. If the allocation length in the command descriptor block is too small to transfer information about all configured logical units, the LUN list length value shall not be adjusted to reflect the truncation.

6.22. REQUEST SENSE 03h

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (03h)							
1	Obsolete			Reserved				
2	Reserved							
3	Reserved							
4	Allocation Length (1Ch)							
5	Control							

The REQUEST SENSE command requests that the target transfer sense data to the initiator.

The Sense Data will be valid for a CHECK CONDITION or RESERVATION CONFLICT status returned on the previous command. The Sense data will be preserved by the target until retrieved by the REQUEST SENSE command or until the receipt of any other command from the same initiator. The 28 bytes of Sense data are cleared upon receipt of any subsequent command to the logical unit, including another REQUEST SENSE.

If the drive receives an unsolicited REQUEST SENSE, then it returns Sense Data with the File-mark, EOM and the appropriate values in the Additional Sense Code/ Additional Sense Code Qualifier fields. These fields are only set if the drive is currently logically positioned at BOM/P, EOM , EOD, or after a File-mark or after a Set-mark. The Host is required to know what the current direction of tape motion is and, therefore to know whether the logical position at a File-mark or Set-mark is either on the BOT or EOT side of that mark.

The positional information provided reflects the logical position of the drive. The drive returns information based on the data still in its buffer as well as the data on tape.

The REQUEST SENSE command does not cause the drive to flush its buffered data to tape. Therefore, if the Host requires the exact physical positioning of the media, it should precede the REQUEST SENSE with a WRITE FILEMARKS command with the number of File-marks field = 0 and with the immediate bit set to ZERO. This command will force the drive to flush any currently buffered data to tape. A subsequent REQUEST SENSE will return the initiator the actual physical (and logical) position of the drive.

Note: The drive will only maintain valid positional information on normal operating commands. If the SEND DIAGNOSTIC or READ/WRITE BUFFER commands are sent to the drive, valid positional information will not be returned in response to an unsolicited REQUEST SENSE.

Allocation Length: The Allocation Length specifies the maximum number of sense bytes to be returned. The drive terminates the transfer when the Allocation Length bytes have been transferred or when all available sense data has been transferred to the Host, whichever is less.

The returned sense information has the following format:

Table 6-87: Error Codes 70h and 71h Sense Data Format

Bit / Byte	7	6	5	4	3	2	1	0
0	Valid	Error Code (70h or 71h)						
1	Segment Number							
2	File-mark	EOM	ILI	Reserved	Sense Key			
3	(MSB)	Information Bytes						
6								(LSB)
7	Additional Sense Length (14h)							
8	(MSB)	Command-Specific Information						
11								(LSB)
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	Field Replaceable Unit Code							
15	SKSV	Sense-Key Specific						
17								
18	Reserved							
19	(MSB)	Read/Write Data Error Counter						
21								(LSB)
22	(MSB)	Remaining Tape						
25								(LSB)
26	Reserved				CLN	Reserved		MEW
27	Reserved							

Valid: A valid bit of one indicates that the Information Bytes hold residual data as defined in the SCSI spec.

Error Code: A value of 70h indicates a current error, i.e. the report is associated with the most recently received command. A value of 71h indicates a deferred error, i.e. the report is associated with a previous command and is not as a result of the current command. No other values will be returned.

Segment Number: Contains the number of the current segment descriptor if the REQUEST SENSE command is in response to a COPY command. Otherwise this byte is ZERO.

File-mark: This bit indicates that the current command has read a File-mark or a Set-mark. Reporting of Set-marks is optional and indicated by the RSmk bit in the MODE SENSE/SELECT Device Configuration Parameter page.

EOM: An End-Of-Medium (EOM) bit of ONE indicates that an End-Of-Medium condition exists. This bit, when set, indicates that the drive is at or past the Logical Early Warning Point if the direction was forward, or that the command could not be completed because Beginning-Of-Partition was encountered if the direction was reverse. The drive will also set the Sense Key to NO SENSE and the Additional Sense Code Qualifier to either 04h for Beginning of Partition or 02h for End of Partition.

For WRITE type operations, the drive will return a CHECK CONDITION on any operation which occurs following detection of the Early Warning End-of-Partition marker. The EOM and Additional Sense Code fields will be set.

For READ type operations, the drive will not return a CHECK CONDITION until the drive encounters the physical End-of-Partition.

Note that at PHYSICAL End-of-Partition, a WRITE FILEMARK command will cause the command to terminate with a CHECK CONDITION and a sense key of VOLUME OVERFLOW.

ILI: This is the Incorrect Length Indicator bit, which indicates that the requested logical block length did not match the logical block length of the data on the medium. Only READ or VERIFY may cause this bit to be set.

Information Bytes: The conditions of these bytes will contain the differences (residue) of the requested length minus the actual length in either bytes, blocks, File-marks or Set-marks as determined by the command. (Negative values are indicated by two's complement notation.) These bytes will be valid for all READ, WRITE, SPACE and VERIFY commands for which a CHECK CONDITION status has been generated. These bytes will be ZERO for MODE SELECT/SENSE, INQUIRY, READ BLOCK LIMITS and TEST UNIT READY commands.

Additional Sense Length: This specifies the number of additional sense bytes that are to follow. If the Allocation Length of the Command Descriptor Block is too small to transfer all of the additional sense bytes, the Additional Sense Length is not adjusted to reflect the truncation.

Command Specific Information Bytes: Command Specific Bytes are unused, and will be ZERO.

Additional Sense Code and Additional Sense Code Qualifier: These two bytes provide additional information about what caused the CHECK CONDITION status. They are used extensively by the drive. The information is presented in the Sense Key Description table on the following pages.

Field Replaceable Unit Code: This byte is used to define a device specific mechanism or part that has failed. A value of ZERO indicates that no specific mechanism or unit has been identified to have failed.

The units and their values are:

00h - Unable to identify failed unit
01h - Drive Mechanism
02h - Drive Electronics

Sense Key specific bytes: These fields will contain data that further defines the nature of the CHECK CONDITION.

If the sense field is set to ILLEGAL REQUEST and the SKSV bit is set to one, the Sense Key specific fields will be as shown below. The fields point to illegal parameters sent by the Host.

Table 6-88: Field Pointer Bytes

Bit / Byte	7	6	5	4	3	2	1	0
15	SKSV(1)	C/D	Reserved	Reserved	BPV	Bit Pointer		
16	(MSB)	Field Pointer						
17								(LSB)

C/D: When this bit is set, it indicates that the illegal parameter is in the Command Descriptor Block. A C/D of ZERO indicates that the illegal parameter is in the Parameter List sent by the Host during the DATA OUT phase.

BPV: When the Bit Pointer Valid bit is set, indicates that the Bit Pointer field specifies which bit of the byte designated by the Field Pointer is in error. When a multiple-bit field is in error, the Bit Pointer field points to the most significant (left most) bit of the field.

Field Pointer: This field indicates which byte of the Command Descriptor Block or of the Parameter List data was in error. Bytes are numbered from ZERO. When a multiple byte field is in error, the pointer points to the most significant byte of the field.

If the SKSV bit is ZERO, then the Field Pointer Bytes take the Sony Unique Format as shown below:

Table 6-89: Error Code and Status Bytes

Bit / Byte	7	6	5	4	3	2	1	0
15	SKSV(0)	Reserved						
16	Runtime Error Code							
17	Status Byte							

Runtime Error Code: This field is part of the internal protocol and contains the Runtime (error set 0) Error code. These internal error codes are also listed below, showing to which Sense, ASC and ASCQ fields they are mapped.

Status Byte: This field is not supported.

Read/Write Data Error Counter: After a read operation, this field returns "Number of read soft errors" fields of Log data. After a write operation, this field returns "Number of write soft errors" fields of Log data. This field is valid only after a READ or a WRITE command. It is direct mapping of the relevant Log data and is cleared/reset in the same way as the Log data.

Remaining Tape: The capacity remaining of the tape in 1024 byte blocks is returned. This means the area from the current logical position to EOP.

CLN: When this bit is set, it indicates drive request cleaning . Refer to the clause 4.5.1

MEW: When this bit is set, it indicates Media Warning. Refer to the clause 4.5.2.3

A description of the different Sense Keys (Byte 2), Additional Sense Codes (Byte 12), and the Additional Sense Code Qualifiers (Byte 13) supported by the SDX-900V are listed in a table beginning on the following page.

The following Table shows the REQUEST Sense Keys and the Additional Sense Key (Byte 12) and the Additional Sense Key Qualifier (Byte 13) supported by the SDX-900V:

Table 6-90: Sense Key Descriptions

Sense Key	Bytes 12 13	Description
00h		NO SENSE: Indicates that there is no specific sense key information to be reported for the designated logical unit. This would be the case for a successful command or a command that received CHECK CONDITION or COMMAND TERMINATED status because one of the File-mark, EOM, or ILI bits is set to one. For File-mark or Set-mark detected the drive will be positioned on the EOM side of the mark if the drive direction was forward and on the BOM side of the mark if the direction was reverse.
	00 00	NO ADDITIONAL SENSE INFORMATION
	00 01	FILEMARK DETECTED
	00 02	END-OF-PARTITION/MEDIUM DETECTED
	00 03	SETMARK DETECTED
	00 04	BEGINNING-OF-PARTITION/MEDIUM DETECTED
	00 05	END-OF-DATA DETECTED
01h		RECOVERED ERROR.
	5D 00	FAILURE PREDICTION THRESHOLD EXCEEDED
02h		NOT READY. Indicates that the logical unit addressed cannot be accessed. Operator intervention may be required to correct this condition. Typically this indicates that there is no tape loaded. This status is also returned if the drive is currently rewinding following REWIND with Immediate bit set and another command is received (except for INQUIRY and READ BLOCK LIMITS which return GOOD status).
	04 00	LOGICAL UNIT NOT READY - Media is present within the drive. This status is returned to any tape motion command following UNLOAD with Immediate bit set or if the Eject button has been pressed by the operator. Also can be caused by the command sequence, PREVENT ALLOW MEDIA REMOVAL with Prevent bit set followed by UNLOAD. Tape motion commands such as READ, WRITE or SPACE are not allowed but Diagnostics which do not access the tape are permitted.
	04 01	LOGICAL UNIT IS IN PROCESS OF BECOMING READY - This status is returned following a LOAD command with the IMMED bit set for any tape motion command before the tape is loaded. Also during the auto load following a tape insertion.
	30 03	CLEANING CARTRIDGE INSTALLED
	3A 00	MEDIUM NOT PRESENT - This status is returned for all tape motion commands when there is no media within the tape.
	3A 04	MEDIUM NOT PRESENT MAM ACCESSIBLE

03h		MEDIUM ERROR. Indicates that the current command or a previously acknowledged write-type operation terminated with a non-recovered error condition that was probably caused by a flaw in the medium, an error in the recorded data or the cleanliness of the head. This sense key may also be returned if the drive is unable to distinguish between a flaw in the medium and a specific hardware failure (sense key 4h). This condition is also marked by the Valid bit being set, indicating that the information bytes contain residue information.
	00 02	END-OF-PARTITION / MEDIUM DETECTED
	0C 00	WRITE ERROR – The Read-After-Write Retry limit was exceeded during Write. Probably caused by a flaw in the media.
	11 00	UNRECOVERED READ ERROR - C1, C2 & C3 Error Correction could not correct a Read Error. Probably caused by a flaw in the media.
	11 08	INCOMPLETE BLOCK READ - The drive could not read the AITFormat Group containing the requested block. Could be caused by head clogging or media damage.
	14 03	END-OF-DATA NOT FOUND – While Reading a AIT format tape, the drive encountered blank (unformatted) media during a Read operation. This error could be caused by serious head clogging.
	15 02	POSITIONING ERROR DETECTED BY READ OF MEDIUM - Cannot find destination Group during Space operation.
	27 04	APPEND POSITION ERROR
	30 00	INCOMPATIBLE MEDIUM INSTALLED - Format violation. Possible that the Sub-Area cannot be read.
	30 02	CANNOT READ MEDIUM, INCOMPATIBLE FORMAT - Format violation, non-AIT-4 Format.
	30 07	CLEANING FAILURE
	31 00	MEDIUM FORMAT CORRUPTED - AIT format Group GIT, BAT, or Sub-Codes do not match or are improper.
	33 00	TAPE LENGTH ERROR - Attempting to select partition 1 on a single tape. Requested partition size in MODE SELECT - Medium Partitions Parameter page is too large (exceeds tape length) or too small (0< requested partition size in frames < 2541).
	3B 08	REPOSITION ERROR - Position lost during Read, Verify, Write, Space, Locate, Seek or Select Partition operation.
	50 00	WRITE APPEND ERROR - Cannot find the last frame of the Group and therefore, cannot append.
	52 00	CARTRIDGE FAULT
	70 NN	DECOMPRESSION EXCEPTION SHORT ALGORITHM ID OF NN - ALGORITHM ID <= 255
	83 03	MIC Checksum Error

04h		HARDWARE ERROR. Indicates that the drive detected a non-recoverable hardware failure not related to the tape (for example, controller failure, device failure, parity error, etc).While performing the command or during a self-test. If a previously acknowledged write-type operation was the cause, the valid bit is set. The error code in sense byte 16 will indicate the specific problem. Refer to the error code table in the diagnostics clause for more information.
	03 00	PERIPHERAL DEVICE WRITE FAULT - Drive electronics did not report successful completion to a Write operation.
	3F 01	MICROCODE HAS BEEN CHANGED – Illegal firmware code is reprogrammed.
	44 00	INTERNAL TARGET FAILURE - Any unexpected internal error Conditions Indicating a Non-recoverable hardware failure. Refer to the field replaceable unit code field (sense byte 14) to determine which part of the drive is failing. Host should issue SEND DIAGNOSTICS with the self-test bit set to thoroughly test the drive. This sense information could also be returned after a send diagnostics command ends with a check condition status. Host should issue RECEIVE DIAGNOSTICS RESULTS for more details. Possible causes: buffer overrun/under-run, format violation, mechanical status time-out, internal data parity error, byte count mismatch, incorrect micro processor operation, unexpected SCSI protocol chip interrupt.
	83 06	MIC READ ERROR
05h		ILLEGAL REQUEST. Indicates that there was an illegal parameter in the Command Descriptor Block or in the additional parameters supplied as data for some commands. If the target detects an invalid parameter in the command descriptor block, then it shall terminate the command without altering the medium. If the target detects an invalid parameter in the additional parameters supplied as data, then the target may have already altered the medium. This sense key may also indicate that an invalid IDENTIFY message was received.
	1A 00	PARAMETER LIST LENGTH ERROR - Indicates that the Parameter Length error in the Command Descriptor Block. Either the value does not fall on a Header, Page or Block descriptor boundary or the Parameter List Length is unexpectedly large.
	20 00	INVALID COMMAND OPERATION CODE - Invalid or Unsupported command.
	24 00	INVALID FIELD IN CDB – Bits are set in one or more fields are not supported or are Reserved. Refer to the Field Pointer (Bytes 15-17) to identify the illegal bit or field.
	25 00	LOGICAL UNIT NOT SUPPORTED - The SDX-900V has an embedded SCSI controller with only one Logical Unit (LUN). The error indicates that the LUNTRN field in the Identify message was not ZERO.
	26 00	INVALID FIELD IN PARAMETER LIST - Test Number, Configuration Number Header, or Field in the Parameter List was invalid or selected Diagnostic test is not Host assessable.
	26 01	PARAMETER NOT SUPPORTED - Unsupported page requested. Refer to the Field Pointer (Bytes 15-17) to identify the illegal bit or field.
	26 02	PARAMETER VALUE INVALID
	2C 00	COMMAND SEQUENCE ERROR - Write Buffer command when tape is inserted and not at BOT.
	39 00	SAVING PARAMETERS NOT SUPPORTED
	3D 00	INVALID BITS IN IDENTIFY MESSAGE - Identify message was not 80h or C0h.

05h	55 04	INSUFFICIENT REGISTRATION RESOURCES (attempt to register more than 1 key)
	83 02	No MIC Detected
	83 04	MIC out of Memory
	83 05	No Data Body Detected in the MIC
	83 0C	MIC format type is undefined
	83 0D	MIC capacity field indicates illegal value.
	83 80	Partition Count exceeded
	83 89	User Volume Note Size Mismatch
	83 8A	User Partition Note Size Mismatch
	83 97	Current Partition is not the last partition
	83 98	Can not append the new partition, because remaining capacity too short.
	83 99	Can not delete partition
	83 9B	Can not format tape because real tape capacity is exceeded
	83 9C	Can not append new partitions because the MIC is out of memory
06h		UNIT ATTENTION. Indicates that the removable medium may have been changed or the target has been reset.
	28 00	NOT READY TO READY TRANSITION, MEDIUM MAY HAVE CHANGED
	29 00	POWER ON, RESET, OR BUS DEVICE RESET OCCURRED
	29 80	Drive Failed Power-on test or Diagnostic - (SONY Unique)
	2A 01	MODE PARAMETERS CHANGED - Issued to all other initiators after one initiator changes any Mode Parameter.
	2A 03	RESERVATION PREEMPTED (after removing reservation by the CLEAR action)
	2A 05	REGISTRATION PREEMPTED (after removing reservation by the PREEMPT or PREEMPT ABORT action)
	3F 11	MEDIUM AUXILIARY MEMORY ACCESIBLE
	83 87	Broken MIC is loaded in AIT mode
07h		DATA PROTECT. Indicates that a WRITE type of operation was attempted on a write protected tape, write operation is not performed.
	27 00	WRITE PROTECTED – Cassette is Write Protected.
	83 0B	BROKEN MIC – Cassette is Write Protected
08h		BLANK CHECK. Indicates the drive encountered blank medium or end-of-data indication while reading.
	00 00	NO ADDITIONAL SENSE INFORMATION - Blank Tape was encountered at BOT
	00 05	END-OF-DATA DETECTED - During READ or SPACE command.
09h		Vendor Specific
	83 08	MIC is not formatted yet
	83 0B	MIC is broken
	83 83	MIC is exist but is not used

0Bh		ABORTED COMMAND
	43 00	MESSAGE ERROR – Unexpected Message phase.
	45 00	SELECT OR RESELECT FAILURE - SCSI Selection/ Re-selection error.
	47 00	SCSI PARITY ERROR - SCSI Parity Error detected and drive proceeded to Status phase.
	48 00	INITIATOR DETECTED ERROR MESSAGE RECEIVED.
	4A 00	COMMAND PHASE ERROR
	4B 00	DATA PHASE ERROR – Possible DMA error
	4E 00	OVERLAPPED COMMANDS ATTEMPTED - Host issued a new command to the drive while a previous command was being executed.
0Dh		VOLUME OVERFLOW
	00 02	END-OF-PARTITION/MEDIUM DETECTED - During Write type operation.
0Eh		MISCOMPARE. Not supported by the SDX-900V
0Fh		RESERVED. Not used by SDX-900V

REQUEST SENSE returns the CHECK CONDITION status only to report fatal errors for the REQUEST SENSE command.

For example:

The target receives a non ZERO reserved bit in the command descriptor block.

An un-recovered parity error occurs on the Data Bus.

A target malfunction prevents return of the sense data.

The Allocation Length falls between block boundaries.

Following a fatal error on REQUEST SENSE, the sense data should be considered invalid. The host may attempt recovery by selecting the drive and issuing a BUS DEVICE RESET message directly following the IDENTIFY message. This forces the drive to do a hard reset. If the fault persists, the host should deny access to the drive.

6.23. RESERVE UNIT (6/10) 16h and 56h

Table 6-91: RESERVE UNIT (6) CDB format

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (16h)							
1	Reserved			Obsolete				
2	Obsolete							
3	Reserved							
4	Reserved							
5	Control							

Table 6-92: RESERVE UNIT (10) CDB format

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (56h)							
1	Reserved			3rdPty	Reserved		Long ID	Reserved
2	Obsolete							
3	Third Party Device ID							
4	Reserved							
5	Reserved							
6	Reserved							
7-8	Parameter List Length							
9	Control							

The RESERVE (6/10) command reserves the Logical Unit for exclusive use by the requesting initiator or one other specified SCSI device (3rd party). The RELEASE (6/10) command is used to release the Logical Unit if it was reserved by the requesting initiator using a RESERVE (6/10) command and is still in the reserved state.

See PERSISTENT RESERVE OUT/IN for an alternate reservation system. The PERSISTENT RESERVE OUT command cannot be used to release a reservation generated by the RESERVE (6/10) commands.

Third party reservation management operations are only allowed using RESERVE (10) and RELEASE (10).

Logical Unit reservation management operations are allowed using RESERVE (6/10) and RELEASE (6/10).

The reservation remains in effect until one of the following conditions is met:

- The initiator that made the reservation sends another RESERVE UNIT command.
- The Logical Unit is released by a RELEASE (6/10) command from the same initiator.
- The Logical Unit in a 3rd Party reservation is released by a RELEASE (10) command from the same initiator.
- A TARGET RESET or LOGICAL UNIT RESET Task Management function is received from any initiator.

The occurrence of the last two conditions is indicated by the Logical Unit returning a CHECK CONDITION status with a sense key of UNIT ATTENTION on the next command following the condition.

It is not an error for an initiator to issue a new RESERVE (6/10) command to the Logical Unit when the Logical Unit is currently reserved by that same initiator. If the Logical Unit has previously been reserved by another initiator, then the Logical Unit terminates the command with RESERVATION CONFLICT status.

If, after honoring the reservation, any other initiator then attempts to perform any command except INQUIRY, REQUEST SENSE, REPORT LUNS or RELEASE UNIT, then the command is rejected with a RESERVATION CONFLICT status. A RELEASE UNIT command issued by another initiator will be ignored by that reserved logical unit.

Obsolete: These fields are not supported and must be set to ZERO.

If this field is not ZERO, the command is terminated with CHECK CONDITION status and the Sense Key is set to ILLEGAL REQUEST. The Additional Sense Code is set to INVALID FIELD IN CDB.

3rd Party: Third Party Release allows an initiator to reserve a logical for third party operations.

If the value in this field is 0b, a Logical Unit reserve is requested.

If 3rdPty = 1b, the Logical Unit reserves the specified logical unit, but only if the initiator, 3rdPty bit, and Third Party Device ID fields (in CDB or in Parameter List). The Logical Unit retains this information to determine when a 3rd Party release function is valid.

LongID: If the Long ID bit is set to 1b and 3rd Party is set to 1b and the Parameter List Length is 8, the parameter list contains the eight bytes of the device ID of the Third Party Device ID.

If the 3RDPTY bit is zero, the LONGID bit field is ignored.

This is required for Fiber Channel since each Device ID is at least three bytes long.

Third-Party Device ID: If the Third-Party bit is ZERO, then the Third-Party Reservation option is not requested. If the 3rdPty bit is one, a RESERVE UNIT reserves the drive for the SCSI device specified in the Third-Party Device ID field (LongID = 0b) or the parameter data (LongID = 1b). The Logical Unit preserves the reservation until any one of the conditions mentioned above occurs.

The Logical Unit ignores any attempt made by any other initiator to release the reservation and returns GOOD status.

If the Third Party Device ID value is equal to or smaller than 255, the LongID field may be 0b and the Third Party Device ID value is sent in this field.

The contents of the Third Party Device ID field in the CDB is ignored when LongID = 1b; see Parameter List Length.

Note: If the Third Party Device ID value is greater than 255 (FFh), LongID must be set to 1b.

Parameter List Length: The contents of this field specify the length, in bytes, of the parameter list that is transferred from the initiator to the Logical Unit.

If the 3RDPTY bit is set to ZERO or LongID is set to ZERO, the PARAMETER LIST LENGTH field is ignored.

The field value is ignored when LongID = 0b.

The field value must be at least 8 when LongID = 1b.

If LongID = 0b and Parameter List Length is not ZERO, the command is terminated with CHECK CONDITION status and the Sense Key is set to ILLEGAL REQUEST. The Additional Sense Code is set to INVALID FIELD IN CDB.

If LongID = 1b and Parameter List Length is not at least eight (8), the command is terminated with CHECK CONDITION status and the Sense Key is set to ILLEGAL REQUEST. The Additional Sense Code is set to INVALID FIELD IN CDB.

An initiator that holds a current reservation may modify that reservation e.g., switch third-parties by issuing another RESERVE UNIT command to the drive.

If the logical unit has previously been reserved by another initiator, the Logical Unit returns RESERVATION CONFLICT status.

When the LongID bit = 1b, the parameter list has the format shown in Table 6-93.

Table 6-93: RESERVE (10) LongID Only Parameter List — Data Format

Bit Byte	7	6	5	4	3	2	1	0
0 - 7	(MSB) Third Party Device ID (LSB)							

The Logical Unit supports superseding reservations. If a superseding reservation cannot be granted because of conflicts with a previous reservation, other than the reservation being superseded, the Logical Unit returns RESERVATION CONFLICT status.

6.24. REWIND 01h

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (01h)							
1	Obsolete			Reserved				Immed
2	Reserved							
3	Reserved							
4	Reserved							
5	Control							

REWIND tells the drive to position the media at the beginning of the currently active partition. Before rewinding, the drive writes any buffered data to tape and appends an EOD marker.

Immed: When this bit is set, the drive writes any remaining buffered data followed by an EOD marker to tape. It then returns status to the Host before beginning the actual rewind operation. If the Immediate bit is not set, status will be returned after the rewind has completed.

6.25. SEND DIAGNOSTIC 1Dh

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Dh)							
1	Obsolete			PF	Reserved	Self Test	DevOfl(0)	UnitOfl
2	Reserved							
3	(MSB)	Parameter List Length						
4								(LSB)
5	Control							

SEND DIAGNOSTIC tells the drive to perform diagnostic tests on itself.

PF: The drive expects the Page Format bit to be set to indicate that the parameters transferred during the DATA OUT phase will include four bytes of header information as well as the diagnostic test bytes.

If this bit is not set the parameter bytes will only describe the diagnostic test. Note that if the Self Test bit is set, this bit must be ZERO else the drive will return CHECK CONDITION with the ILLEGAL REQUEST sense key set.

Self Test: When this bit is set the drive executes its POWER-ON SEQUENCE. The Parameter List Length must be ZERO when this bit is set other-wise the drive will return a CHECK CONDITION status with an ILLEGAL REQUEST sense key set. After Self Test, a LOAD command is required to bring the drive online.

DevOfl: Device Off-line is not supported and shall be set to ZERO, otherwise the driver will return a CHECK CONDITION status with an ILLEGAL REQUEST SENSE key set.

UnitOfl: This bit must be set for proper operation of any diagnostic test except Self Test. If this bit is not set, except for self-test, the drive will return a CHECK CONDITION status with an ILLEGAL REQUEST sense key set.

Parameter List Length: This field provides the count of the number of Parameter List bytes which will be transferred in the DATA OUT phase. These bytes describe the test that is to be run. This field must be set to ZERO if the Self-Test bit is set.

If the PF bit is ZERO, the Parameter List describes the diagnostic test to be executed. The diagnostic tests are five bytes in length. If the Parameter List Length is not set to five or ZERO if the Self-Test bit is set , the drive returns a CHECK CONDITION status with an ILLEGAL REQUEST sense key set.

If the PF bit is set, the Parameter List includes a four byte header as of the form:

Table 6-94: Diagnostic Page Format

Bit / Byte	7	6	5	4	3	2	1	0
0	Page Code							
1	Reserved							
2	(MSB)	Page Length (n-3)						
3								(LSB)

Page Code: The drive supports two Page Codes:

00h - Return Supported pages
81h - Drive Diagnostic page

For Page Code 00h, the Page Length must be ZERO and the Parameter List Length must be set to four otherwise the drive returns a CHECK CONDITION status with an ILLEGAL REQUEST sense key set. This Page Code requests that the drive return a list of the supported pages in the DATA IN phase of RECEIVE DIAGNOSTIC.

For Page Code 81h, the Page Length must be five and the Parameter List Length must be set to nine otherwise the drive returns a CHECK CONDITION status with an ILLEGAL REQUEST sense key set. This page Code instructs the drive to execute the five bytes of diagnostic test that follow the four bytes of header. The five bytes of diagnostic test information will be of the form:

Table 6-95: Diagnostic Test information

Bit / Byte	7	6	5	4	3	2	1	0
0	Diagnostic Test Number							
1	Break	Loop Count Identifier						
2	Parameter A							
3	Parameter B							
4	Parameter C							

Diagnostic Test Number: Number identifying which test to execute

Break: Indicates how to terminate the loop count should an error occur.

0 = stop on first error
1 = do not stop on error

Loop Count Identifier: The number of times that the test should be repeated before status is returned.

1 = run once
1 = run once
2 = run 10 times
3 = run 100 times
4 = run 1000 times

Parameters A, B, C: Any additional parameters required to fully define the diagnostic test.

If the test completes successfully, the drive returns GOOD status. If the test failed, CHECK CONDITION status is returned with a HARDWARE ERROR Sense Key and an Additional Sense Code of DIAGNOSTIC FAILURE set. The Host should then send a REQUEST DIAGNOSTIC command which will return information as to which test failed and the nature of the failure. If the test requested is not defined, not available to the requested processor, or not executable in the current configuration, this information will be reported in the data returned by the REQUEST DIAGNOSTIC command.

Refer to clause 7, Drive Diagnostics for more detailed information about the supported diagnostic tests and test operations.

6.26. SET DEVICE IDENTIFIER A4h

Table 6-96: SET DEVICE IDENTIFIER command

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (A4h)							
1	Reserved			Service Action (06h)				
2 – 5	Reserved							
6 – 9	Parameter List Length							
10	Reserved							
11	Control							

The SET DEVICE IDENTIFIER command (Table 6-96) requests that the device identifier information in the logical unit be set to the value received in the SET DEVICE IDENTIFIER command parameter list. In this implementation, only Service Action 06h is supported (all other options are for disk array use (SCC-2)).

The Identifier set by an initiator may be from 0 (reset) to 64 bytes in increments of 1 byte.

The identifier is preserved over power cycles and reset events (see the REPORT DEVICE IDENTIFIER command).

Service Action: Service Action must be 06h.

If the Service Action is not 06h, the command is terminated with CHECK CONDITION status, the sense key is set to ILLEGAL REQUEST, and the ASC/ASCQ is set to INVALID FIELD IN CDB.

Parameter List Length: Parameter List Length specifies the length in bytes of the Identifier that is transferred from the application client to the Logical Unit. The maximum value for this field is 64 bytes; the minimum is 0.

If the parameter list length exceeds 64, the command is terminated with CHECK CONDITION status, the sense key is set to ILLEGAL REQUEST, and the ASC/ASCQ is set to INVALID FIELD IN CDB.

A parameter list length of ZERO indicates that no data is to be transferred, the identifier in the Logical unit is to be set to zero length, and subsequent REPORT DEVICE IDENTIFIER commands return an Identifier length of zero.

The SET DEVICE IDENTIFIER parameter list contains the identifier to be set by the logical unit (see Table 6-97).

Table 6-97: SET DEVICE IDENTIFIER Parameter List — Data Format

Bit / Byte	7	6	5	4	3	2	1	0
0 - <= 63	Identifier							

The Identifier field is an initiator selected value, to be returned in subsequent valid REPORT DEVICE IDENTIFIER commands or until reset or until replaced by another valid SET DEVICE IDENTIFIER command.

On successful completion of a SET DEVICE IDENTIFIER command a unit attention shall be generated for all initiators except the initiator that issued the SET DEVICE IDENTIFIER command with service action 06h. When reporting the unit attention condition the additional sense code shall be set to DEVICE IDENTIFIER CHANGED.

6.27. SPACE 11h

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (11h)							
1	Obsolete			Reserved		Code		
2	(MSB)							
3				Count				
4								(LSB)
5	Control							

SPACE provides a variety of positioning functions that are determined by the Code and Count fields in the Command Descriptor Block. Both forward (toward EOM/P) and reverse (toward BOM/P) positioning are provided.

Code: The supported values are:

Table 6-98: SPACE codes

Code	Description
000b	Blocks
001b	File-marks
011b	End-Of-Data
100b	Set-marks

Note: The drive will reject a SPACE Set-mark command if it has not configured through MODE SELECT to report Set-marks. The drive will return a CHECK CONDITION status with the Sense data set to ILLEGAL REQUEST. In this command description the word “mark” is used to mean File-mark or Set-mark. Only where their responses differ shall File-mark and Set-mark be referred explicitly.

Count: When spacing over blocks or marks, the Count field is interpreted as follows:

A positive value N causes forward movement over N blocks or marks. The tape is logically positioned after the Nth block (or mark) on the EOM/P side.

A ZERO value causes no change in the logical position.

A negative value -N (2’s complement notation) causes reverse movement over N blocks or marks. The tape is logically positioned on the BOM /P side of the Nth block (or mark).

When spacing to EOD, the Count field is ignored. Forward movement occurs until the drive encounters EOD. The position is such that a subsequent WRITE command would append data after the last entity that has been written to tape before EOD.

When executing a SPACE, the drive implements the following hierarchy: Blocks (lowest), File-marks, Set-marks, EOD, BOM/P or EOM/P (highest)

Therefore, SPACE N blocks will halt with GOOD status after the Nth block, or with CHECK CONDITION status on any occurrence of File-mark, Set-mark, EOD, BOM/P or EOM/P. SPACE N File-marks will halt on the Nth File-mark or on any occurrence of Set-mark, EOD, BOM/P or EOM/P, and so on. Within the Sense data, the fields will be set as described on the following table.

Table 6-99: SPACE CHECK CONDITION results

Spacing	Event Detected	Sense Data					
		Valid	Mark	EOM	Sense Key	ASC/ASCQ	Note
Blocks	File-mark	1	1	0	No Sense	File-mark Detected	a,b
	Set-mark	1	1	0	No Sense	Set-mark Detected	a,b,d
	EOD	1	0	0	Blank Check		b,e
	BOT	1	0	1	No Sense	BOM/P Detected	b,f
	Phy EOT	1	0	1	Medium Error	EOM/P Detected	b,g
File-marks	Set-mark	1	1	0	No Sense	Set-mark Detected	a,b,d
	EOD	1	0	0	Blank Check		b,e
	BOT	1	0	1	No Sense	BOM/P Detected	b,f
	Phy.EOT	1	0	1	Medium Error	EOM/P Detected	b,g
Set-marks	EOD	1	0	0	Blank Check		b,e
	BOT	1	0	1	No Sense	BOM/P Detected	b,f
	Phy.EOT	1	0	1	Medium Error	EOM/P Detected	b,g
EOD	BOT	0	0	1	No Sense	BOM/P Detected	c,f
	Phy.EOT	0	0	1	Medium Error	EOM/P Detected	c,g

Note a: The logical position is located on the EOM side of the mark if movement was in the forward direction and on the BOM side of the mark if movement was in the reverse direction.

Note b: The Information field is set to the difference (residue) between the requested count and the actual number of blocks, file marks, Set-marks, or spaced over.

Note c: The Information field will contain no residue count and therefore the Valid bit is not set.

Note d: The drive will only report that a Set-mark has been detected while spacing over blocks or File marks, if it has been configured through MODE SELECT to Report Set-marks. Otherwise, the drive will continue the space operation and the presence of the Set-mark will be transparent to the Host.

Note e: The tape is positioned such that a subsequent WRITE would append data after the last entity that has been written to the tape before EOD.

Note f: The tape is physically positioned at BOM/P.

Note g: EOM is only reported when the physical EOM/P is encountered. The tape is physically positioned at EOM/P.

6.27.1. CHECK CONDITION

NO SENSE: If a File-mark occurs while spacing over blocks, the File-mark and Valid bits in extended sense are set to one. The Information bytes are set to the difference (residue) between the requested count and the actual number of blocks spaced over (not including the mark).

If a Save Set Mark occurs while spacing over blocks or File-marks, nothing is reported unless the SDX-900V C has been configured through MODE SELECT to Report Save Set Marks.

If the Report Save-Set Marks configuration is enabled and a Save-Set Mark occurs while spacing over blocks or File marks, the Valid bit and the Additional Sense keys in the Returned Sense data are set to indicate that a Save-Set Mark has been encountered. The information bytes are set to the difference (residue) in the requested count and the actual number of blocks or Save-Set Marks spaced over (not including the detected Save-Set Mark).

If End-of-Data is detected while spacing over blocks or marks, the Valid bit and the Additional Sense Keys in the Returned Sense Data are set to indicate that an EOD mark has been encountered. The Information bytes are set to the difference (residue) in the requested count and the actual number of blocks or marks spaced over.

If BOT is detected while spacing over blocks or marks in the reverse direction, the EOM bit is set in extended sense. The Valid bit is set to one and the Information bytes to the difference (residue) between the requested count and the actual number of blocks or File marks spaced over.

6.28. TEST UNIT READY 00h

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (00h)							
1	Obsolete			Reserved				
2	Reserved							
3	Reserved							
4	Reserved							
5	Control							

TEST UNIT READY checks if the drive is ready. This is not a request for a self-test. If the drive has a tape loaded, this command will return a GOOD status. Otherwise, CHECK CONDITION will be reported and the sense key will be NOT READY.

Table 6-100: TEST UNIT READY results

Drive Status	Sense Key	ASC/ASCQ Description
Tape Loaded	00 No Sense	00 NO ADDITIONAL SENSE INFORMATION
No Tape Present	02 Not Ready	3A 00 MEDIUM NOT PRESENT
Tape Loading	02 Not Ready	04 01 LOGICAL UNIT IS BECOMING READY
Tape Unloading	02 Not Ready	04 00 LOGICAL UNIT NOT READY
Tape Unloaded (but retained in drive)	02 Not Ready	04 00 LOGICAL UNIT NOT READY

6.29. WRITE 0Ah

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (0Ah)							
1	Obsolete			Reserve				Fixed
2	(MSB)							
3				Transfer Length				
4								(LSB)
5	Control							

WRITE transfers one or more blocks from the Host to the tape beginning at the current logical position.

Fixed: The Fixed Bit specifies both the meaning of the Transfer Length field and whether fixed-length or variable-length blocks are to be transferred.

If the Fixed bit is set to ZERO, Variable Block mode is selected. The Transfer Length specifies the maximum number of bytes that the drive handshakes out from the initiator. A single block is transferred from the initiator and is written beginning at the current logical tape position. Upon successful termination, the tape is logically positioned after this block (EOM/P side). The Transfer Length specifies the maximum number of bytes that the drive handshakes out from the initiator.

If the Fixed Bit is set to one, the Transfer Length field specifies the number of blocks to be transferred to the drive, beginning at the current logical position. This is valid only if the drive is currently operating in Fixed Block mode, in other words, when it has been instructed to use fixed-length blocks with MODE SELECT. The current block length is the block length defined in the MODE SELECT command. Upon termination, the tape is logically positioned after these blocks (EOM/P side).

If EOT is detected while writing, the drive will finish writing any buffered data. The command will terminate with CHECK CONDITION status. Within the Sense data, the EOM bit is set, the Sense Key field is set to NO SENSE and the Additional Sense Code and Additional Sense Code Qualifier fields are set to EOM/P detected. The drive will attempt to complete any subsequent writes, returning a CHECK CONDITION status in each case.

Note: If the host issue a write command with the odd block size and Wide SCSI, the CHECK CONDITION STATUS will be reached and the sense key will be set to ILLEGAL REQUEST.

If the drive encounters the physical EOM when attempting a WRITE, a CHECK CONDITION status is returned. Within the Sense data, the EOM and Valid bits are set and the Sense Key field is set to VOLUME OVERFLOW. The Information fields contain the residue count and the Additional Sense Code and Additional Sense Code Qualifier fields are set to EOM/P Detected. The tape is physically positioned at EOM/P.

If the Transfer Length is ZERO, no data will be transferred and the current position on the logical unit will not be changed.

The drive flushes its write buffer to tape and appends an EOD marker under the following conditions:

1. Receipt of the following non-write commands:

   READ
   SPACE
   ERASE
   READ BUFFER
   WRITE BUFFER
   REWIND
   LOAD/UNLOAD
   MODE SELECT
   LOCATE

The buffer can be maintained through the following media commands, assuming that no other flush condition has been met, for example, write hold-off time-out.

WRITE

WRITE FILE MARKS with Immediate bit set

2. The write hold-off time limit is exceeded.

6.30. WRITE ATTRIBUTE 8Dh

The WRITE ATTRIBUTE command (table 6-101) allows an application client to write attributes to medium auxiliary memory. Application clients should issue the READ ATTRIBUTE command prior to using this command to discover device server support for medium auxiliary memory.

Table 6-101: WRITE ATTRIBUTE command

Bit / Byte	7	6	5	4	3	2	1	0
0	OPERATION CODE (8Dh)							
1	Reserved (0)							
2	(MSB) Reserved for SMC –2 devices (0)							
3								(LSB)
4	Reserved for SMC –2 devices (0)							
5	VOLUME NUMBER							
6	Reserved (0)							
7	PARTITION NUMBER							
8	Reserved (0)							
9	Reserved (0)							
10	(MSB)							
11	PARAMETER LIST LENGTH							
12								
13								(LSB)
14	Reserved (0)							
15	CONTROL							

The VOLUME NUMBER specifies a volume within the Medium Auxiliary Memory. The number of volumes of the MAM shall equal that of the attached multi-volume medium. If the medium only has a single volume, then this field shall be set to zero.

The PARTITION NUMBER specifies a partition within a volume. The number of partitions of the MAM shall equal that of the attached multi-partition medium. If the medium only has a single partition, then this field shall be set to zero.

If the combination of VOLUME NUMBER and PARTITION NUMBER is not valid, the command shall be terminated with a CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST, and the additional sense data shall be set to INVALID FIELD IN CDB.

The PARAMETER LIST LENGTH field specifies the length in bytes of the parameter list contained in the DATA-OUT Buffer. A parameter list length of zero indicates that no parameter data is present; this shall not be considered an error. If the parameter list length results in the truncation of an attribute, the WRITE ATTRIBUTE command shall be terminated with a CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall be set to PARAMETER LIST LENGTH ERROR.

The parameter list shall have the format shown in table 6-102. Attributes should be sent in ascending numerical order. If the attributes are not in order, no attributes shall be changed and the WRITE ATTRIBUTE command shall be terminated with a CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall be set to INVALID FIELDIN PARAMETER LIST.

Table 6-102: WRITE ATTRIBUTE parameter list format

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)							
3	PARAMETER DATALENGTH (n-3)							(LSB)
4 . .	ATTRIBUTE 0							
...								
. . n	ATTRIBUTE x							

The PARAMETER DATA LENGTH field should contain the number of bytes of attribute data and should be ignored by the device server.

The format of the attribute is described later.

If there is not enough space to write the attributes to the medium auxiliary memory, no attributes shall be changed and the WRITE ATTRIBUTE command shall be terminated with a CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall be set to AUXILIARY MEMORY OUT OF SPACE.

If the medium auxiliary memory is not accessible because there is no medium present, no attributes shall be changed and the WRITE ATTRIBUTE command shall be terminated with a CHECK CONDITION status. The sense key shall be set to NOT READY and the additional sense code shall be set to AUXILIARY MEMORY NOT ACCESSIBLE.

If the Medium Auxiliary Memory has failed (e.g. bad checksum) the WRITE ATTRIBUTE command shall be terminated with a CHECK CONDITION status. The sense key shall be set to MEDIUM ERROR and the additional sense code shall be set to AUXILIARY MEMORY WRITE ERROR.

If the WRITE ATTRIBUTE command parameter data contains an attribute with an ATTRIBUTE LENGTH field set to zero, then one of the following actions shall occur:

If the attribute state is unsupported or read only, no attributes shall be changed and the WRITE ATTRIBUTE command shall be terminated with a CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall be set to INVALID FIELD IN PARAMETERLIST;

If the attribute state is read/write, the attribute shall be changed to the nonexistent state. The attribute shall not be returned in response to a READ ATTRIBUTE command and not reported by the read ATTRIBUTE command with ATTRIBUTE LIST service action; or

If the attribute state is nonexistent, the attribute in the WRITE ATTRIBUTE command parameter list shall be ignored; this shall not be considered an error.

If any of the following conditions occur, no attributes shall be changed, the WRITE ATTRIBUTE command shall be terminated with a CHECK CONDITION status, the sense key shall be set to ILLEGAL REQUEST, and the additional sense code shall be set to INVALID FIELD IN PARAMETER LIST.

If the parameter data attempts to change an attribute in the read only state.

If the parameter data contains an attribute with INCORRECT ATTRIBUTE LENGTH field contents; or

If the parameter data contain an attribute with unsupported ATTRIBUTE VALUE field contents.

6.31. WRITE BUFFER 3Bh

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (3Bh)							
1	Obsolete			Reserved	Mode			
2	Buffer ID							
3	(MSB)	Buffer Offset						
5								(LSB)
6	(MSB)	Parameter List Length						
8								(LSB)
9	Control							

WRITE BUFFER is used in conjunction with the READ BUFFER command as a diagnostic function.

WRITE BUFFER command is valid only when there is no tape inserted in the drive, or when the tape is positioned at BOT. An attempt to issue the Write Buffer command when the tape is not at BOT will result in a CHECK CONDITION status with a Request Sense Key of ILLEGAL REQUEST.

Note: The drive will write any buffered data to tape prior to executing this command. Any data that is then transferred by the WRITE BUFFER is not written to tape.

Mode: The drive supports the following values within the Mode field. If any other value is set, the drive will terminate the command with a CHECK CONDITION status and an ILLEGAL REQUEST sense key set.

Any Write Data, file-marks or set-marks in buffer will be transfer to tape before this command is executed.

Table 6-103: WRITE BUFFER Mode Field

Mode	Description
0000b	Write combined header and data
0010b	Write data
1010b	Echo Buffer

Combined Header and Data Mode - in this mode, the test data to be transferred must be preceded by a four-byte header. The four-byte header consists of all reserved bytes. The Parameters List Length specifies the maximum number of bytes that will be transferred during the DATA OUT phase. This number includes four bytes of header, so the data length to be stored in the buffer is transfer length minus four. The initiator should ensure that the transfer length is not greater than four plus the available length that is returned in the header of the READ BUFFER command.

Data Mode - in this mode, the DATA OUT phase contains only buffer test data.

Table 6-104: WRITE BUFFER Mode Field

Buffer ID: The supported values are:

Buffer ID	Description	Offset
0	Write Group Buffer	0 - 0x01000000
80	Write Group Buffer	0 - 0x01000000
81	Write Group Buffer	0x01000000 - 0x02000000
82	Write Group Buffer	0x02000000 - 0x03000000
83	Write Group Buffer	0x03000000 - 0x04000000

If an unsupported Buffer ID code is requested, the drive returns a CHECK CONDITION status with an ILLEGAL REQUEST sense key.

Buffer Offset: The buffer offset field contains the byte offset within the specified buffer from which data shall be transferred to. The initiator should conform to the offset boundary requirements returned in the WRITE BUFFER descriptor. If the target is unable to accept the specified buffer offset, it shall return CHECK CONDITION status, shall set the Sense Key to ILLEGAL REQUEST, and set the Additional Sense Code to ILLEGAL FIELD IN CDB.

Parameter List Length: specifies the maximum number of bytes that will be transferred during the Data Out phase. The initiator should attempt to ensure that the Parameter List Length does not exceed the buffer capacity. If this does occur, the drive returns a CHECK CONDITION status with an ILLEGAL REQUEST sense key set. The capacity of the buffer can be determined from the Buffer capacity field in the Read Buffer descriptor. The Parameter List Length must be greater than four (except in data only mode), else the drive will return a CHECK CONDITION status with an ILLEGAL REQUEST sense key set.

Echo Buffer: In this mode the data shall be stored in an echo buffer. Data shall be sent aligned on four-byte boundaries. The BUFFER ID and BUFFER OFFSET fields are ignored in this mode. The drive assigns echo buffer on a per initiator basis. The initiator should attempt to ensure that the parameter list length does not exceed the capacity of the echo buffer. The BUFFER CAPACITY field in the READ BUFFER echo buffer descriptor determines the capacity of the echo buffer. If the PARAMETER LIST LENGTH field exceeds the buffer capacity, the drive will return CHECK CONDITION status with a Request Sense Key of ILLEGAL REQUEST.

6.32. WRITE FILEMARKS 10h

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (10h)							
1	Obsolete			Reserved			WSmk	Immed
2	(MSB)	Number of File-marks or Set-marks						
3								
4								(LSB)
5	Control							

WRITE FILEMARKS causes the specified number of File-marks or Set-marks to be written, beginning at the current logical position on tape.

WSmk: If this bit is set, the drive writes a Set-mark to tape instead of a File-mark.

Immed: If this bit is set, the drive returns status as soon as the Command Descriptor Block has been validated. An Immediate bit of ZERO indicates that status will not be returned until the operation has completed.

Number of File-marks or Set-marks: This is the number of consecutive marks to be written to tape. A value of ZERO is not considered an error and GOOD status is returned.

This command may be used to force the drive to write any buffered data to the tape. The requested mark(s) will be appended to the data and the write buffer will be flushed to tape. A ZERO value in the Number of File-marks field indicates that no File-marks are to be written to the tape but the write buffer is still flushed to tape.

If EOT is detected while writing the marks, the drive will finish writing any buffered data. The command will terminate with CHECK CONDITION status. Within the Sense data, the EOM bit is set, the Sense Key field is set to NO SENSE and the Additional Sense Code and Additional Sense Code Qualifier fields are set to EOM/P detected. The drive will attempt to complete any subsequent WRITE FILEMARKS, returning a CHECK CONDITION status in each case.

If the drive encounters the physical EOM when attempting a WRITE FILEMARKS, CHECK CONDITION status is returned. Within the Sense data, the EOD and Valid bits are set and the Sense Key field is set to VOLUME OVERFLOW. The Information fields contain the residue count and the Additional Sense Code and Additional Sense Code Qualifier fields are set to EOM/P Detected. The tape is physically positioned at EOM/P.

7. Drive Diagnostics

This clause deals with the diagnostics supported by the SDX-900V. Each diagnostic is described in detail and possible error codes are discussed.

7.1. Overview

The diagnostic firmware for this product is designed to achieve the following objectives:

- Isolate hardware failures
- Verify the media
- Provide predictive information which can lead to the early detection of potential problems
- Provide remote support capabilities
- Satisfy manufacturing testing needs

How these objectives are achieved:

- Fault isolation is achieved by providing an extensive set of diagnostic tests.
- Media verification is achieved by error rate testing and tape logs.
- Predictive data is provided in the form of a tape log and runtime error logs. Logs are maintained within the drive's RAM, EEPROM and on the AIT cassettes.
- Remote support capability is provided by allowing all tests and test sequences to be initiated via the host interface. Similarly, all test results are reported back to the host via the interface.
- Manufacturing needs are satisfied by providing unrestricted access to all internal tests.

7.2. Diagnostic Test

This clause describes the Diagnostic Test facilities of the drive. The method for executing tests and receiving test results from the Host is described and a full list of available tests and possible result messages is given.

Diagnostics can be initiated in several ways:

- Power-on Self Test
- Send Diagnostic command initiating a Self Test
- Send Diagnostic command initiating a specific test or sequence

Each type of Diagnostics will be described in detail.

7.2.1. Power-on Self Test

Each time power is applied to the drive it will automatically perform a series of diagnostics on itself to insure that the basic functions of the drive are performing properly. The power-on Self Test sequence is shown below:

Power supply voltage exceeds power-up threshold

61	Main Processor ROM checksum
62	Main Processor Destructive RAM Test
70	SDX-900V Controller Register Test

The following 3 tests are initiated by the Mechanism Controller automatically after power-up and therefore would be executing in parallel with the tests listed above.

20	Mechanism Controller Microprocessor Test
30	Front Panel Check
79	Data Compression Functions DMA Line Test
71	Buffer RAM Test

If a failure occurs with any of the power-on diagnostic tests the drive will halt with the Status LED flashing.

If an error is detected during power-up, the drive will return CHECK CONDITION status to the host on the first command received. The host shall issue a REQUEST SENSE command to determine the cause of the CHECK CONDITION status. The Sense data returned by the drive will have a Sense Key of 6 (Unit Attention) and the ASC/ASCQ will be 29 80 (Drive failed power or test or diagnostic). The host can then issue a RECEIVE DIAGNOSTIC RESULT command to the drive in order to identify the specific diagnostic test that failed and the failure error code.

The drive should be checked by a qualified person to determine what action should be taken.

7.2.2. SEND DIAGNOSTIC command - Self Test

The host computer can request that the drive perform a Self Test on itself to verify that it is functioning normally. The Self Test bit in the SEND DIAGNOSTIC command is set to one, and the Parameter List Length is ZERO. This initiates the Self Test Diagnostic which is similar to the Power-on self test except that non-destructive RAM testing is substituted for the destructive RAM tests.

If an error is detected during this test, the drive will return CHECK CONDITION status to the host. The host shall issue a REQUEST SENSE command to determine the cause of the CHECK CONDITION status. The Sense data returned by the drive will have a Sense Key of 4 (Hardware Error) and the ASC/ASCQ will be 44 00 (Internal Target Failure). The host can then issue a RECEIVE DIAGNOSTIC RESULT command to the drive in order to identify the specific diagnostic test that failed and the failure error code.

The drive should be checked by a qualified person to determine what action should be taken.

7.2.3. SEND DIAGNOSTIC command - Individual Test

The SEND DIAGNOSTIC command also provides the capability to run each of the diagnostic tests individually. In order to identify the diagnostic test to be executed, the SEND DIAGNOSTIC command should be configured as follows:

Self Test bit = 0
Device Off-line bit = 0
Unit Off-line bit = 1
Parameter List Length = 5 or 9 (see below)

The SDX-900V supports both the SCSI-1 and SCSI-2 implementations of the SEND DIAGNOSTIC command.

In the SCSI-1 mode, the Page Format (PF) bit is ZERO and the Parameter List Length is 5, the Parameter List in this case is 5 bytes long and will be of the form:

Table 7-1: SEND DIAGNOSTIC Parameter - SCSI-1

Bit / Byte	7	6	5	4	3	2	1	0
0	Diagnostic Test number							
1	Break	Loop Count						
2	Parameter A							
3	Parameter B							
4	Parameter C							

In SCSI-2 mode, the Page Format (PF) bit is one, and the Parameter List Length is 9, the Parameter List in this case is 9 bytes long and will be of the form:

Table 7-2: SEND DIAGNOSTIC Parameters - SCSI-2

Bit / Byte	7	6	5	4	3	2	1	0
0	Page Code (81h)							
1	Reserved							
2	(MSB)	Page Length (00 05h)						
3								(LSB)
4	Diagnostic Test Number							
5	Break	Loop Count Identifier						
6	Parameter A							
7	Parameter B							
8	Parameter C							

Break: Indicates how to terminate the loop count should an error occur.

0 = stop on first error
1 = do not stop on error

Loop Count Identifier: The number of times that the test should be repeated before status is returned.

0 = run once
1 = run once
2 = run 10 times
3 = run 100 times
4 = run 1000 times

Parameters A, B, C: Any additional parameters required to fully define the diagnostic test. These parameters are unused and shall be 00h.

7.2.4. Diagnostic Test Number Summary

The following is a list of the diagnostic capabilities of the SDX-900V. The Test Availability Code indicates if a particular test can be executed by the Host computer or is executed during Power-on diagnostics (or both). The drive also supports three types of diagnostics:

1. Individual Tests - Self contained modules designed to test a particular function of drive
2. Sequences - Automatic execution of a series of individual tests
3. Exercisers - Verification of a major function of the drive such as Read, Write, Search, etc.

The Diagnostic Test Number for each Test, Sequence or Exerciser is shown in the first column.

Test Availability Codes

P — Power–on Self–test

H — Host Diagnostics

PH — both

Sequence Test

00	Reset Sequence (61, 63, 71,72, 77-79, 80, 81, 30)	H

Mechanism Controller Kernel Test

20	Mechanism Controller Microprocessor Test	P

Main Processor Kernel Test

61	Main Processor ROM checksum	P
62	Main Processor Destructive RAM Test	P

Drive Test

71	Buffer RAM Test	PH
79	Data Compression Functions and DMA Line Test	PH
80	Internal Message Bus Test	PH

7.2.5. RECEIVE DIAGNOSTIC RESULT command

Whenever a diagnostic test is executed, the drive automatically prepares a diagnostic test result that can be returned to the host computer when a RECEIVE DIAGNOSTIC RESULT command is issued.

If the PF bit in the SEND DIAGNOSTIC command was sent to one, the diagnostic test result will be preceded by a four byte header which will be of the form:

Table 7-3: RECEIVE DIAGNOSTIC RESULT - SCSI-2 Header

Bit / Byte	7	6	5	4	3	2	1	0
0	Page Code (81h)							
1	Reserved							
2	(MSB)	Page Length (00 05h)						
3								(LSB)

Regardless of the PF bit in the SEND DIAGNOSTIC command, the five bytes of diagnostic test result information will be of the form:

Table 7-4: RECEIVE DIAGNOSTIC RESULT

Bit / Byte	7	6	5	4	3	2	1	0
0	Reset Error	Time Re-Sync	Reserved		Error Set			
1	Error Code							
2	Result A							
3	Result B							
4	Diagnostic Test Number							

Reset error: This bit is set when an error occurs during power-on self-test.

Time Re-Sync: This bit indicates that the time stamp saved with the error log has no relation to that of the previous entry. It is only set by the logging routine within the data buffer as an error is logged.

Error set: Two set of error codes exist. The definition of the error is dependent upon when set is taken from as follows:

0 - Runtime errors
2 - Drive diagnostic errors

Error code: Error codes for each error set are described in clause 7.2.6

Result A: Typically this byte indicates the logical sub-assembly that failed:

1 - Drive Mechanism
2 - Drive Circuitry

Note: This byte has alternate meanings with some diagnostics. Refer to clause 7.2.6.

Result B: Typically this byte is unused however, this byte has alternate meanings with some diagnostics. Refer to clause 7.2.6.

Test number: This is the test number to which the message applies (if a test fails within a sequence, the individual test number will be returned).

Note: Diagnostic test 30 (Front Panel Check) will light each of the front panel LEDs so that the operator can verify that the LEDs are functioning. There is no error detection within the drive for this test and therefore the Error Code, Result A and Result B will always be ZERO.

7.2.6. Diagnostics Results Reference

The following list of error codes are supported by the drive.

Error Sets - Error Code

Error Set 0 - Runtime Errors

00h	NO ERROR
01h	NO TAPE
02h	OFF-LINE WITH TAPE
04h	ILLEGAL COMMAND
05h	BOT ENCOUNTERED
07h	WRITE PROTECTED
08h	PARTITION SIZE ERROR
09h	PRE-RECORDED TAPE
0Ah	INVALID FORMAT FOR READ
0Bh	NOT AT BOT
10h	INVALID TEST NUMBER
11h	INVALID PARAMETER
12h	INVALID TEST WITH CARTRIDGE
13h	INVALID TEST
14h	TEST NOT ACCESSIBLE DUE TO SELF TEST ERROR
22h	BLANK AT BOT
28h	SYSTEM AREA READ CONDITION ERROR
29h	SYSTEM AREA READ APPROACH TIMEOUT
2Ah	SYSTEM AREA READ OVER POSITION
2Ch	SYSTEM AREA WRITE CONDITION ERROR
2Dh	SYSTEM AREA APPEND TIMEOUT
2Eh	SYSTEM AREA APPEND OVER POSITION
30h	EOD ENCOUNTERED
32h	BLANK ENCOUNTERED
33h	HEAD CLOGGED on READ
35h	ECC UN CORRECTABLE
36h	READ APPROACH TIMEOUT
38h	READ OVER POSITION
39h	READ FORMAT ERROR
3Ah	READ FRAME OVER
3Fh	READ TIMEOUT
44h	SEARCH APPROACH TIMEOUT
45h	SEARCH ECC UNCORRECTABLE
48h	SEARCH OVER POSITION
49h	SEARCH FORMAT ERROR
4Ah	SEARCH FRAME OVER
4Fh	SEARCH TIMEOUT
51h	TOO MANY REWRITE
52h	WRITE CONDITION ERROR
53h	HEAD CLOGGED ON WRITE
54h	EOM DETECTED ON WRITE
55h	APPEND TIME-OUT
57h	APPEND OVER POSITION
59h	ATF UNLOCK
5Ah	APPEND DBP NG
5Bh	FORMAT TIMEOUT
5Dh	WRITE FRAME OVER
5Fh	WRITE TIMEOUT

67h	ASDA FRAME OVER
68h	ECC FRAME OVER
6Bh	MC COMMAND REJECT ERROR
6Dh	MC MISC ERROR
75h	DIAGNOSTIC FAILURE
77h	FBI COMMAND TIME-OUT
78h	DMA Parity Error SCSI Controller
79h	DMA Parity Error Interface Buffer Controller
7Ah	DMA Parity Error Data Compression Controller
7Bh	DMA Parity Error Tape Formatter Controller
7Ch	DRAM Parity Error Interface Buffer Controller
7Dh	DRAM Parity Error Tape Formatter Controller
80h	LOADING TIME-OUT
81h	FRONT LOADING TIME-OUT
82h	CAPSTAN TIME-OUT
83h	DRUM TIME-OUT
84h	REEL TIME-OUT
85h	ILLEGAL ENCODER PATTERN
86h	EEPROM IN THE DRIVE IS NG
87h	TENSION REGULATOR NG
88h	DC DC CONVERTER NG
8Eh	SNAPPED TAPE
90h	FEW S REEL FG
91h	FEW T REEL FG
92h	HIGH TEMPERATURE
93h	DEW SENSED
94h	TAPE SLACK
A0h	DRUM SPEED OUT OF RANGE
A3h	DRUM PHASE UNLOCKED
A4h	DRUM NO FG
A5h	DRUM NO PG
B0h	CAPSTAN TERM OUT OF RANGE SHORT
B2h	CAPSTAN TERM OUT OF RANGE LONG
B8h	TATF ERROR
BEh	MC INITIALIZATION ERROR
BFh	MC COMMUNICATION ERROR
C0h	UNKNOWN BAT ENTRY
C1h	Illegal Format
C2h	FORMAT DISCONTINUITY
CCh	UNEXPECTED EOR
CDh	ILLEGAL SKIP COUNT
CEh	ALDC ERROR
CFh	ILLEGAL DMA COMPLETION
E0h	DMA IS ABORTED
E4h	FMK ENCOUNTERED
E5h	SMK ENCOUNTERED
E6h	BOP ENCOUNTERED
E7h	EOD ENCOUNTERED
E9h	DMA ERROR

F0h	MIC BROKEN ERROR
F1h	MIC NOT SUPPORTED
F2h	RFD ERROR
F4h	CLEANING EOM ENCOUNTERED
F7h	APPEND POSITION ERROR
F8h	ILLEGAL TAPE
F9h	ILLEGAL FIRMWARE
FAh	UNDEFINED TAPE
FBh	FIRMWARE MISCELLANEOUS ERROR
FCh	FIRMWARE VERIFICATION FAILURE
FDh	FIRMWARE TAPE FAILURE
FEh	FIRMWARE REPROGRAMMING FAILURE

Error set 2 - Diagnostic error

02h	MAIN PROCESSOR ROM CHECK SUM TEST FAILURE
06h	MAIN PROCESSOR DESTRUCTIVE RAM TEST FAILURE
07h	MAIN PROCESSOR NON DESTRUCTIVE RAM TEST FAILURE
12h	BUFFER RAM TEST FAILURE
14h	INTERNAL MESSAGE BUS TEST FAILURE
15h	DATA COMPRESSION DMA LINE TEST FAILURE
20h	MECHANISM CONTROLLER MICROPROCESSOR TEST FAILURE

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8. APPENDIX A: ASC & ASCQ Alphabetic Order

ASC and ASCQ Assignments
Alphabetic Order

BYTE 12	13	DESCRIPTION
55	06	AUXILIARY MEMORY OUT OF SPACE
11	12	AUXILIARY MEMORY READ ERROR
0C	0B	AUXILIARY MEMORY WRITE ERROR
00	04	BEGINNING-OF-PARTITION/MEDIUM DETECTED
14	04	BLOCK SEQUENCE ERROR
83	87	BROKEN MIC IS LOADED IN AIT MODE
30	02	CANNOT READ MEDIUM - INCOMPATIBLE FORMAT
30	05	CANNOT WRITE MEDIUM - INCOMPATIBLE FORMAT
52	00	CARTRIDGE FAULT
30	07	CLEANING FAILURE
30	03	CLEANING CARTRIDGE INSTALLED
4A	00	COMMAND PHASE ERROR
2C	00	COMMAND SEQUENCE ERROR
4B	00	DATA PHASE ERROR
70	NN	DECOMPRESSION EXCEPTION SHORT ALGORITHM ID OF NN
29	80	DRIVE FAILED POWER-ON TEST OR DIAGNOSTIC - (SONY Unique)
00	05	END-OF-DATA DETECTED
14	03	END-OF-DATA NOT FOUND
00	02	END-OF-PARTITION/MEDIUM DETECTED
5D	00	FAILURE PREDICTION THRESHOLD EXCEEDED
00	01	FILEMARK DETECTED
30	00	INCOMPATIBLE MEDIUM INSTALLED
11	08	INCOMPLETE BLOCK READ
48	00	INITIATOR DETECTED ERROR MESSAGE RECEIVED
55	04	INSUFFICIENT REGISTRATION RESOURCES
44	00	INTERNAL TARGET FAILURE
3D	00	INVALID BITS IN IDENTIFY MESSAGE
20	00	INVALID COMMAND OPERATION CODE
24	00	INVALID FIELD IN CDB
26	00	INVALID FIELD IN PARAMETER LIST
49	00	INVALID MESSAGE ERROR
04	01	LOGICAL UNIT IS IN PROCESS OF BECOMING READY
04	10	LOGICAL UNIT NOT READY, AUXILIARY MEMORY NOT ACCESSIBLE
04	00	LOGICAL UNIT NOT READY, CAUSE NOT REPORTABLE

25	00	LOGICAL UNIT NOT SUPPORTED
15	01	MECHANICAL POSITIONING ERROR
3F	11	MEDIUM AUXILIARY MEMORY ACCESIBLE
31	00	MEDIUM FORMAT CORRUPTED
3A	00	MEDIUM NOT PRESENT
3A	04	MEDIUM NOT PRESENT_MEDIUM AUXILIARY MEMORY ACCESIBLE
43	00	MESSAGE ERROR
3F	01	MICROCODE HAD BEEN CHANGED
2A	01	MODE PARAMETERS CHANGED
00	00	NO ADDITIONAL SENSE INFORMATION
28	00	NOT READY TO READY TRANSITION
		(MEDIUM MAY HAVE CHANGED)
4E	00	OVERLAPPED COMMANDS ATTEMPTED
1A	00	PARAMETER LIST LENGTH ERROR
26	01	PARAMETER NOT SUPPORTED
26	02	PARAMETER VALUE INVALID
2A	00	PARAMETERS CHANGED
47	00	PARITY ERROR
03	00	PERIPHERAL DEVICE WRITE FAULT
27	04	PERSISTENT WRITE PROTECT
15	02	POSITIONING ERROR DETECTED BY READ OF MEDIUM
29	00	POWER ON, RESET, OR BUS DEVICE RESET OCCURRED
2A	05	REGISTRATION PREEMPTED
2A	03	RESERVATION PREEMPTED
3B	08	REPOSITION ERROR
39	00	SAVING PARAMETER NOT SUPPORTED
45	00	SELECT OR RESELECT FAILURE
00	03	SETMARK DETECTED
33	00	TAPE LENGTH ERROR
11	00	UNRECOVERED READ ERROR
50	00	WRITE APPEND ERROR
0C	00	WRITE ERROR
27	00	WRITE PROTECTED

9. APPENDIX B: ASC & ASCQ Numeric Order

ASC and ASCQ Assignments
Numeric Order

BYTE 12	13	DESCRIPTION
00	00	NO ADDITIONAL SENSE INFORMATION
00	01	FILEMARK DETECTED
00	02	END-OF-PARTITION/MEDIUM DETECTED
00	03	SETMARK DETECTED
00	04	BEGINNING-OF-PARTITION/MEDIUM DETECTED
00	05	END-OF-DATA DETECTED
03	00	PERIPHERAL DEVICE WRITE FAULT
04	00	LOGICAL UNIT NOT READY, CAUSE NOT REPORTABLE
04	01	LOGICAL UNIT IS IN PROCESS OF BECOMING READY
04	10	LOGICAL UNIT NOT READY, AUXILIARY MEMORY NOT ACCESSIBLE
0C	00	WRITE ERROR
0C	0B	AUXILIARY MEMORY WRITE ERROR
11	00	UNRECOVERED READ ERROR
11	08	INCOMPLETE BLOCK READ
11	12	AUXILIARY MEMORY READ ERROR
14	03	END-OF-DATA NOT FOUND
15	01	MECHANICAL POSITIONING ERROR
15	02	POSITIONING ERROR DETECTED BY READ OF MEDIUM
1A	00	PARAMETER LIST LENGTH ERROR
20	00	INVALID COMMAND OPERATION CODE
24	00	INVALID FIELD IN CDB
25	00	LOGICAL UNIT NOT SUPPORTED
26	00	INVALID FIELD IN PARAMETER LIST
26	01	PARAMETER NOT SUPPORTED
26	02	PARAMETER VALUE INVALID
27	00	WRITE PROTECTED
27	04	PERSISTENT WRITE PROTECT
28	00	NOT READY TO READY TRANSITION (MEDIUM MAY HAVE CHANGED)
29	00	POWER ON, RESET, OR BUS DEVICE RESET OCCURRED
29	80	DRIVE FAILED POWER-ON TEST OR DIAGNOSTIC - (SONY Unique)
2A	00	PARAMETERS CHANGED
2A	01	MODE PARAMETERS CHANGED
2A	03	RESERVATION PREEMPTED

2A	05	REGISTRATION PREEMPTED
2C	00	COMMAND SEQUENCE ERROR
30	00	INCOMPATIBLE MEDIUM INSTALLED
30	02	CANNOT READ MEDIUM - INCOMPATIBLE FORMAT
30	03	CLEANING CARTRIDGE INSTALLED
30	05	CANNOT WRITE MEDIUM - INCOMPATIBLE FORMAT
30	07	CLEANING FAILURE
31	00	MEDIUM FORMAT CORRUPTED
33	00	TAPE LENGTH ERROR
39	00	SAVING PARAMETER NOT SUPPORTED
3A	00	MEDIUM NOT PRESENT
3A	04	MEDIUM NOT PRESENT_MEDIUM AUXILIARY MEMORY ACCESIBLE
3B	08	REPOSITION ERROR
3D	00	INVALID BITS IN IDENTIFY MESSAGE
3F	01	MICROCODE HAD BEEN CHANGED
3F	11	MEDIUM AUXILIARY MEMORY ACCESIBLE
43	00	MESSAGE ERROR
44	00	INTERNAL TARGET FAILURE
45	00	SELECT OR RESELECT FAILURE
47	00	PARITY ERROR
48	00	INITIATOR DETECTED ERROR MESSAGE RECEIVED
49	00	INVALID MESSAGE ERROR
4A	00	COMMAND PHASE ERROR
4B	00	DATA PHASE ERROR
4E	00	OVERLAPPED COMMANDS ATTEMPTED
50	00	WRITE APPEND ERROR
52	00	CARTRIDGE FAULT
55	04	INSUFFICIENT REGISTRATION RESOURCES
55	06	AUXILIARY MEMORY OUT OF SPACE
5D	00	FAILURE PREDICTION THRESHOLD EXCEEDED
70	NN	DECOMPRESSION EXCEPTION SHORT ALGORITHM ID OF NN
83	87	BROKEN MIC IS LOADED IN AIT MODE

10. APPENDIX C: SCSI Commands (Op Code Order)

The following is a list of the supported SCSI Commands and page index:

PARA	SCSI COMMAND	OP CODE	PAGE
6.28	TEST UNIT READY	00h	6-102
6.24	REWIND	01h	6-95
6.22	REQUEST SENSE	03h	6-85
6.14	READ BLOCK LIMITS	05h	6-71
6.12	READ	08h	6-65
6.29	WRITE	0Ah	6-103
6.32	WRITE FILEMARKS	10h	6-108
6.27	SPACE	11h	6-99
6.2	INQUIRY	12h	6-3
6.7	MODE SELECT (6)	15h	6-38
6.23	RESERVE (6)	16h	6-93
6.18	RELEASE (6)	17h	6-79
6.1	ERASE	19h	6-2
6.8	MODE SENSE (6)	1Ah	6-56
6.3	LOAD/UNLOAD	1Bh	6-8
6.17	RECEIVE DIAGNOSTIC RESULTS	1Ch	6-77
6.25	SEND DIAGNOSTIC	1Dh	6-96
6.11	PREVENT ALLOW MEDIUM REMOVAL	1Eh	6-64
6.4	LOCATE	2Bh	6-10
6.16	READ POSITION	34h	6-75
6.31	WRITE BUFFER	3Bh	6-106
6.15	READ BUFFER	3Ch	6-72
6.19	REPORT DENSITY SUPPORT	44h	6-81
6.5	LOG SELECT	4Ch	6-11
6.6	LOG SENSE	4Dh	6-13
6.7	MODE SELECT (10)	55h	6-38
6.23	RESERVE (10)	56h	6-93
6.18	RELEASE (10)	57h	6-79
6.8	MODE SENSE (10)	5Ah	6-56
6.9	PERSISTENT RESERVE IN	5Eh	6-59
6.10	PERSISTENT RESERVE OUT	5Fh	6-62
6.13	READ ATTRIBUTE	8Ch	6-67
6.30	WRITE ATTRIBUTE	8Dh	6-104
6.21	REPORT LUNS	A0h	6-84

6.26	SET DEVICE ID	A4h	6-98
6.20	REPORT DEVICE ID	A3h	6-83

11. APPENDIX D: ASC & ASCQ for AIT (Sony Unique)

ASC and ASCQ Assignments for AIT drive (Sony Unique)
Numeric Order

BYTE 12	13	DESCRIPTION
83h	00h	Reserved
83h	01h	MIC Header Error
83h	02h	No MIC Detected
83h	03h	MIC Checksum Error
83h	04h	MIC out of memory
83h	05h	No Data Body Detected in the MIC
83h	06h	MIC Read Error
83h	07h	No Cassette Detected
83h	08h	MIC is not formatted yet
83h	09h	MIC Write Fault
83h	0Ah	Requested address is write protected on the MIC
83h	0Bh	MIC is broken
83h	0Ch	MIC format type is undefined
83h	0Dh	MIC capacity field indicates illegal value. Acceptable value is 2Kbytes, 4Kbytes, 8Kbytes. The drive will handle the MIC is 2Kbytes, when capacity field indicates illegal value.
83h	0Eh	
:		Reserved
83h	7Fh	
83h	80h	Partition count exceeded
83h	81h	Reserved
83h	82h	Reserved
83h	83h	MIC is exist but is not used
83h	84h	
		Reserved
83h	86h	
83h	87h	Broken MIC is loaded in AIT mode
83h	88h	Reserved
83h	89h	User Volume Note Size mismatch
83h	8Ah	User Partition Note Size mismatch
83h	8Bh	
		Reserved
83h	96h	
83h	97h	Current Partition is not the last partition.
83h	98h	Cannot append the new partition, because the remaining capacity too short.
83h	99h	Cannot delete partition, because the indicated partition number is not appropriate.
83h	9Ah	Encounter the EOT while creating the new partition, append partition command is not completed. (If a drive misleads the tape capacity by some reason, format command will be failed on the way. In case of the situation, the Last Partition Number must hold the Last Valid Partition Number, because it is reasonable and time saving.)
83h	9Bh	Cannot format tape because real tape capacity is exceeded.
83h	9Ch	Cannot append new partitions because the MIC is out of memory.
83h	9Dh	
:		Reserved
83h	FFh	

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12. APPENDIX E: Medium Auxiliary Memory Attribute

12.1. INTRODUCTION

This section will outline the design specifications for the implementation of selected Medium Auxiliary Memory (MAM) attributes.

12.2. OVERVIEW

An increasing number of media types are incorporating small memory components into their products. The creation and acceptance of the "Proposed Addition of Read and Write Attribute Commands to SPC-2" (AM document) provides a uniform method to access the data stored on the Medium Auxiliary Memory. This section will provide details on using MAM with this product.

12.3. REFERENCE

SCSI Primary Commands – 3 (SPC-3) Revision 03
Sections 5.9, 7.14, 7.31 and 8.3.

SCSI Stream Commands SSC-2 Revision 07

SCSI-3 Media Changer Commands –2 Revision 02

12.4. SCSI COMMAND REQUIREMENTS

12.4.1. LOAD COMMAND

The tape device supports the Load/Unload 1Bh command with the additional features as described below.

This command specification is the process of getting the medium loaded into the logical unit but not positioned for access:

A Load bit of one and a HOLD bit of one indicates, if the medium has not been moved into the logical unit, the medium shall be moved in, but not positioned for access. The EOT and RETEN bits shall be set to zero. Following successful completion, the device server shall return GOOD STATUS. If both the medium and the device server support MAM, the device server shall generate a unit attention condition for all initiators with the additional sense code and additional sense code qualifier set to MEDIUM AUXILIARY MEMORY ACCESSABLE.

This command specification is the process of unthreading a medium when it is already loaded into the logical unit:

A LOAD bit of zero and a HOLD bit of one indicates, if the medium is in the logical unit, the medium shall be positioned as specified by the RETEN and EOT bits or shall be unthreaded (whichever is appropriate for the medium type) but shall not be ejected. Following successful completion, the device server shall generate a unit attention condition for all initiators with additional sense code and additional sense code qualifier set to MEDIUM AUXILIARY MEMORY ACCESSIBLE.

If this load is performed, then the LOAD COUNT Attribute in the MAM should not be increased.

This new implementation will not have a negative effect on logical units that do not support this command specification. The default value for the hold bit has been zero, since it was reserved in the prior specifications.

In order to have the medium threaded, another load command must be issued.

Note: The above information has been taken from an unofficial version of the SCSI-3 Stream Commands. In case of any conflict, the published ANSI standard prevails.

Table 12-1

Bit / Byte	7	6	5	4	3	2	1	0
0	OPERATION CODE (1Bh)							
1	Reserved							IMMED
2	Reserved							
3	Reserved							
4	Reserved				HOLD	EOT	RETEN	LOAD
5	CONTROL							

Note: For non-memory component media, the device firmware ignores the above command and threads the tape in order to provide the required data.

12.5. NEW COMMANDS

A MAM attribute is represented in a format described in the next section and is composed of:

1. An attribute identifier,
2. An attribute format code,
3. A bit indicating whether the identified attribute is read only,
4. An attribute length specifying the number of bytes in the identified attribute value, and
5. The value of the identified attribute.

There are three types of attribute (table 12-2)

Table 12-2: Types of MAM Attributes

Attribute Type	Attribute Source	Example	Readable with READ ATTRIBUTE	Writeable with WRITE ATTRIBUTE
Medium	Permanently stored in the medium auxiliary memory during manufacture.	Media Serial Number	Yes	No
Device	Maintained by the device server	Load Count	Yes	No
Host	Maintained by the application client.	Backup date	Yes	Yes

Depending on that attribute type, attributes have the states shown in table 12-3

Table 12-3: MAM Attribute states

Attribute Type	Attribute State	Description
Medium or Device	Read Only	An application server may read the contents of the attribute with the READ ATTRIBUTE command, but an attempt to clear or change the attribute using the WRITE ATTRIBUTE command shall result in the command being terminated with a CHECK CONDITION status. When the READ ONLY bit is one, the attribute is in the read only state.
	Unsupported	The device server does not support the attribute and shall not return it in response to a READ ATTRIBUTE command.
Host	Nonexistent	A host attribute does not exist in the medium auxiliary memory until a WRITE ATTRIBUTE command creates it.
	Read/Write	The attribute has been created using the WRITE ATTRIBUTE command. After the attribute has been created, the contents may be altered using subsequent WRITE ATTRIBUTE commands. A read/write attribute may be returned to be nonexistent state using a WRITE ATTRIBUTE command with the attribute length set to zero. When the READ ONLY bit is zero, the attribute is in the read/write state.

Read and Write Attribute Commands:
The read (8Ch) and write (8Dh) attribute commands will be implemented follows.

12.6. MEDIUM AUXILIARY MEMORY ATTRIBUTE DATA

Attribute Format

Each medium auxiliary memory attribute shall be communicated between the application client and device server in the format shown in table 14.0. This format shall be used in the parameter data for the WRITE ATTRIBUTE command and the READ ATTRIBUTE command. The attribute format in this standard implies nothing about the physical representation of an attribute in the medium auxiliary memory.

Table 12-4: MAM ATTRIBUTE Format

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)							
1	ATTRIBUTE IDENTIFIER							(LSB)
2	READ ONLY	Reserved						FORMAT
3	(MSB)							
4	ATTRIBUTE LENGTH (n-4)							(LSB)
5	(MSB)							
N	ATTRIBUTE VALUE							(LSB)

The ATTRIBUTE IDENTIFIER field contains a code value identifying the attribute.

The READ ONLY bit indicates whether the attribute is in the read only state. If the READ ONLY bit is one, the attribute is in the read only state. If the READ ONLY bit is zero, the attribute is in the read/write state.

The FORMAT field (table 12-5) specifies the format of the data in the ATTRIBUTE VALUE field. ATTRIBUTES defined by this standard include a requirement for the contents of the FORMAT field.

Table 12-5: MAM attribute formats

Format	Name	Description
00b	BINARY	The ATTRIBUTE VALUE shall contain binary data.
01b	ACSII	The ATTRIBUTE VALUE field shall contain only graphic codes (i.e. byte code values 20h through &Eh), shall be left-aligned placing any unused bytes at the highest offset in the field, contain 20h (i.e. ASCII space) in any unused bytes.
10b	TEXT	The attribute contains textual data. The character set is as described in the TEXT LOCALIZATION IDENTIFER attribute.
11b	Reserved	

The ATTRIBUTE LENGTH field specifies the length in bytes of the ATTRIBUTE VALUE field. Attributes defined by this standard include a requirement for the contents of the ATTRIBUTE LENGTH field.

The ATTRIBUTE VALUE Field contains that current (READ ATTRIBUTE) or desired (WRITE ATTRBUTE) value of the attribute.

Attribute identifier values

Attribute identifier values overview

The values in the ATTRIBUTE IDENTIFIER field are assigned according to the attribute type and whether the attribute is standard or vendor unique (table 12-6).

Table 12-6: MAM attribute identifier range assignments

Attribute Identifiers	Attribute Type	Standardization
0000h – 03FFh	Device	Yes
0400h – 07FFh	Medium	Yes
0800h – 0BFFh	Host	Yes
0C00h – 0FFFh	Device	Vendor Unique
1000h – 13FFh	Medium	Vendor Unique
1400h – 17FFh	Host	Vendor Unique
1800h – FFFFh	Reserved	

Device servers shall accept and process a WRITE ATTRIBUTES command containing standardized host type attribute identifier values (i.e. 0800h-0BFFh) or vendor unique host type attribute identifier values (i.e., 1400h-17FFh). Standardized host type attribute identifier values may be checked for conformance to the requirements described later.

Standard device type attributes

Device types attributes (table 12-7) shall be maintained and updated by the device server when the medium and associated medium auxiliary memory are present. All supported medium type attributes shall have a status of read only.

Table 12-7: Device Common Attributes

ID	Attribute Name	#Bytes	Format
0000h	REMAINING CAPACITY IN PARTITION	8	Binary
0001h	MAXIMUM CAPACITY IN PARTITION	8	Binary
0002h	TAPEALERT FLAGS	8	Binary
0003h	LOAD COUNT	8	Binary
0004h	MAM SPACE REMAINING	8	Binary
0005h	ASSIGNING ORGANISATION	8	ASCII
0006h	FORMATTED DENSITY CODE	1	Binary
0007h	INITIALIZATION COUNT	2	Binary
0008h-0209h	Reserved		
020Ah	DEVICE MAKE/SERIAL NUMBER AT LAST LOAD	40	ASCII
020Bh	DEVICE MAKE/SERIAL NUMBER AT LOAD - 1	40	ASCII
020Ch	DEVICE MAKE/SERIAL NUMBER AT LOAD - 2	40	ASCII
020Dh	DEVICE MAKE/SERIAL NUMBER AT LOAD - 3	40	ASCII
020Eh – 021Fh	Reserved		
0220h	TOTAL MBYTES WRITTEN IN MEDIUM LIFE	8	Binary
0221h	TOTAL MBYTES READ IN MEDIUM LIFE	8	Binary
0222h	TOTAL MBYTES WRITTEN IN CURRENT IN CURRENT /LAST LOAD	8	Binary
0223h	TOTAL MBYTES READ IN CURRENT IN CURRENT /LAST LOAD	8	Binary
0224h – 033Fh	Reserved		
0340h	MEDIUM USAGE HISTORY	90	Binary
0341h	PARTITION USAGE HISTORY	60	Binary
0342h – 03FFh			

0000h REMAINING CAPCACITY IN PARTITION and 0001h MAXIMUM CAPACITY IN PARTITION: Are Native capacities assuming no data compression for the specified medium partition. These values are expressed in increments of 1,048,576 bytes (i.e. a value of one means 1,048,576 bytes, two means 2,097,152 bytes, etc).

0002h TAPEALERT FLAGS provides a means of reporting the state of the Tape Alert flags for the previous load of the medium. Each Tape Alert flag occupies one bit (Flag 1 = MSB Byte 1; Flag 64 = LSB, Byte 8). The bits specify all the Tape Alert flags that were set during the previous load. (I.e. the bits are “sticky” for the load).

003h LOAD COUNT: Indicates how many times this medium has been fully loaded. This attribute should not be reset by any action of the device server.

0004h MAM SPACE REMAINING: Indicates the space currently free in the medium auxiliary memory. The total medium auxiliary memory capacity is reported in the MAM CAPACITY attribute.

0005h ASSIGNING ORGANISATION field data identifies the organization responsible for the specifications defining the values in the formatted DENSITY CODE attribute. The ASSIGNING ORGANIZATION field should contain a value listed in the vendor identification list. The use of specific vendor identification, other than the one associated with the device is allowed.

Note: It is intended that this field provide a unique vendor identification of the FORMATTED DENSITY CODE attribute. In the absence of a formal registration procedure, T10 maintains a list of known vendor identification codes in use. Vendors are requested to voluntarily submit their identification codes to T10 to prevent duplication of codes.

0006h FORMATTED DENSITY CODE provides information about the tape format for the user.

0007h INITIALIZATION COUNT: Indicates the number of times that a device server has logically formatted the medium. This figure is cumulative over the life of the medium and shall never be reset.

020Ah, 020Bh, 020Ch, 020Dh DEVICE VENDOR/SERIAL NUMBER AT LAST LOAD, DEVICE VENDOR/SERIAL NUMBERAT LOAD – 1, DEVICE VENDOR/SERIAL NUMBER AT LOAD – 2 AND DEVICE VENDOR/SERIAL NUMBER AT LOAD –3:

Give a rolling history of the last four device servers in which the medium has been loaded. The format of the attributes is shown in table 12-8

Table 12-8: DEVICE VENDOR/SERIAL NUMBER attribute format

Bit Byte	7	6	5	4	3	2	1	0
0	(MSB)							
7	VENDOR IDENTIFICATION							(LSB)
8	(MSB)							
39	PRODUCT SERIAL NUMBER							(LSB)

The VENDOR IDENTIFICATION field shall be the same value returned in the standard INQUIRY data.

The PRODUCT SERIAL NUMBER field contains a vendor unique serial number. If the product serial number is not available, the PRODUCT SERIAL NUMBER field shall contain ASCII spaces (20h).

0220h TOTAL MBYTES WRITTEN IN MEDIUM LIFE and 0221h TOTAL MBYTES READ IN MEDIUM LIFE: Indicate the total number of data bytes that are transferred to or from the medium surface, after any data compression has been applied, over the entire medium life. These values are cumulative and shall never be reset. These values are expressed in increments of 1,048,576 bytes (i.e. a value of one means 1,048,576 bytes, two means2, 097,152 bytes, etc).

0222h TOTAL MBYTES WRITTEN IN CURRENT/LAST LOAD AND 0223h TOTAL MBYTES READ IN CURRENT/LAST LOAD: Indicate the total number of data bytes that are transferred to or from the medium surface, after any data compression has been applied, during the current load if the medium is currently loaded, or the last load if the medium is currently unloaded. The device server should reset these attributes to zero when the medium is loaded. These values are expressed in increments of 1,048,576 bytes
(I.e. a value of one means 1,048,576 bytes, two means 2,097,152 bytes, etc).

0340h MEDIUM USAGE HISTORY: Provides statistical counters (table 12-9) for the entire medium. The value in each field is the sum for all partitions. If a field is not used it should be set to zero.

Table 12-9: Medium USAGE HISTORY attribute format

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)							
5	CURRENT AMOUNT OF DATA WRITTEN							(LSB)
6	(MSB)							
11	The CURRENT WRITE RETRIES COUNT							(LSB)
12	(MSB)							
17	CURRENT AMOUNT OF DATA READ							(LSB)
18	(MSB)							
23	CURRENT READ RETRIES COUNT							(LSB)
24	(MSB)							
29	PREVIOUS AMOUNT OF DATA WRITTEN							(LSB)
30	(MSB)							
35	PREVIOUS WRITE RETRIES COUNT							(LSB)
36	(MSB)							
41	PREVIOUS AMOUNT OF DATA READ							(LSB)
42	(MSB)							
47	PREVIOUS READ RETRIES COUNT							(LSB)
48	(MSB)							
53	TOTAL AMOUNT OF DATA WRITTEN							(LSB)
54	(MSB)							
59	TOTAL WRITE RETRIES COUNT							(LSB)
60	(MSB)							
65	TOTAL AMOUNT OF DATA READ							(LSB)
66	(MSB)							
71	TOTAL READ RETRIES COUNT							(LSB)
72	(MSB)							
77	LOAD COUNT							(LSB)
78	(MSB)							
83	TOTAL CHANGE PARTITION COUNT							(LSB)
84	(MSB)							
89	TOTAL PARTITION INITIALIZE COUNT							(LSB)

The CURRENT AMOUNT OF DATA WRITTEN field indicates the amount of data physically written to the medium during this load of the medium. This value is expressed in increments of 1048576 bytes (e.g., a Value of one means 1048576 bytes, two means 2097152 bytes, etc).

The CURRENT WRITE RETRY COUNT field indicates the total number of write retry was performed during this load of the medium. The exact definition of the error counters is not part of this standard. This counter should not be used to compare products because the products may define errors differently.

The CURRENT AMOUNT OF DATA READ field indicates the amount of data physically read from the medium during this load of the medium. This value is expressed in increments of 1048576 bytes (e.g., a value of one means 1048576 bytes, two means 2097152 bytes, etc.).

The CURRENT READ RETRIES COUNT field indicates the number of times a read retry was performed during this load of the medium. The exact definition of the error counters is not part of this standard. This counter should not be used to compare products because the products may define errors differently.

The PREVIOUS AMOUNT OF DATA WRITTEN field indicates the amount of data physically written to the medium during the previous medium load. This value is expressed in increments of 1048576 bytes (e.g., a value of one means 1048576 bytes, two means 2097152 bytes, etc.).

The PREVIOUS WRITE RETRY COUNT field indicates the total number of write retries during the previous medium load. The exact definition of the error counters is not part of this standard. This counter should not be used to compare products because the products may define errors differently.

The PREVIOUS AMOUNT OF DATA READ field indicates the amount of data physically read from the medium during the previous medium load. This value is expressed in increments of 1048576 bytes (e.g., a value of one means 1048576 bytes, two means 2097152 bytes, etc.).

The PREVIOUS READ RETRIES COUNT field indicates the number of times a read retry was performed during the previous medium load. The exact definition of the error counters is not part of this standard.
This counter should not be used to compare products because the products may define errors differently.

The TOTAL AMOUNT OF DATA WRITTEN field indicates the total amount of data physically written to the medium since the last medium format. This value accumulates over the life of the medium but it is reset to zero after a medium format. This value is expressed in increments of 1048576 bytes (e.g., a value of one means 1048576 bytes, two means 2097152 bytes, etc.).

The TOTAL WRITE RETRIES COUNT field indicates the total number of write retries since the last medium format. This count accumulates over the life of the medium but it is reset to zero after a medium format. The exact definition of the error counters is not part of this standard. This counter should not be used to compare products because the products may define errors differently.

The TOTAL AMOUNT OF DATA READ field indicates the total amount of data physically read from the medium since the last medium format. This value accumulates over the life of the medium but it is reset to zero after a medium format. This value is expressed in increments of 1048576 bytes (e.g., a value of one means 1048576 bytes, two means 2097152 bytes, etc.).

The TOTAL READ RETRIES COUNT field indicates the number of times a read retry was performed since the last medium format. The exact definition of the error counters is not part of this standard. This counter should not be used to compare products because the products may define errors differently. This count accumulates over the life of the medium but it is reset to zero after a medium format.

The LOAD COUNT field indicates the number of loads since the last medium format. This count accumulates over the life of the medium but it is reset to zero after a medium format.

The TOTAL CHANGE PARTITION COUNT field indicates the number of times that switches between partitions have been performed on the medium. This count accumulates over the life of the medium but it is reset to zero after a medium format.

The TOTAL PARTITION INITIALIZE COUNT field indicates the number of times that any of the partitions on the medium have been erased. This count accumulates over the life of the medium but it is reset to zero after a medium format.

PARTITION USAGE HISTORY: Provides statistical counters (table 12-10) for the partition specified by the PARTITION NUMBER field in the CDB. If a field is not used it should be set to zero.

Table 12-10: PARTITION USAGE HISTORY attribute format

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)							
3	CURRENT AMOUNT OF DATA WRITTEN							(LSB)
4	(MSB)							
7	CURRENT WRITE RETIES COUNT							(LSB)
8	(MSB)							
11	CURRENT AMOUNT OF DATA READ							(LSB)
12	(MSB)							
15	CURRENT READ RETRIES COUNT							(LSB)
16	(MSB)							
19	PREVIOUS AMOUNT OF DATA WRITTEN							(LSB)
20	(MSB)							
23	PREVIOUS WRITE RETRIES COUNT							(LSB)
24	(MSB)							
27	PREVIOUS AMOUNT OF DATA READ							(LSB)
28	(MSB)							
31	PREVIOUS READ RETRIES COUNT							(LSB)
32	(MSB)							
35	TOTAL AMOUNT OF DATA WRITTEN							(LSB)
36	(MSB)							
39	TOTAL WRITE RETRIES COUNT							(LSB)
40	(MSB)							
43	TOTAL AMOUNT OF DATA READ							(LSB)
44	(MSB)							
47	TOTAL READ RETRIES COUNT							(LSB)
48	(MSB)							
51	LOAD COUNT							(LSB)
52	(MSB)							
55	CHANGE PARTITION COUNT							(LSB)
56	(MSB)							
59	PARTITION INITIALIZE COUNT							(LSB)

The CURRENT AMOUNT OF DATA WRITTEN, CURRENT WRITE RETRY COUNT, CURRENT AMOUNT OF DATA READ, CURRENT READ RETRIES COUNT, PREVIOUS AMOUNT OF DATA WRITTEN, PREVIOUS WRITE RETRIES COUNT, PREVIOUS AMOUNT OF DATA READ, PREVIOUS READ RETRIES COUNT, TOTAL AMOUNT OF DATA WRITTEN, TOTAL WRITE RETRIES COUNT, TOTAL AMOUNT OF DATA READ, TOTAL READ RETRIES COUNT, LOAD

COUNT fields are as defined for MEDIUM USAGE HISTORY except that they refer to the partition identified by the CDB PARTITION NUMBER field rather than the whole medium.

The CHANGE PARTITION COUNT field indicates the number of times that switches to the partition specified by the PARTITION NUMBER field in the CDB have been performed on the medium. This count accumulates over the life of the medium but it is reset to zero after a medium format.

The PARTITION INITIALIZE COUNT field indicates the number of times that the partition specified by the PARTITION NUMBER field in the CDB has been initialized. This count accumulates over the life of the medium but it is reset to zero after a medium format.

Standard Medium Type Attributes

Medium type attributes (table 12-11) are hard coded into the medium auxiliary memory at manufacture time. All supported medium type attribute shall have a status of read only.

Table 12-11: Medium Common Attributes

ID	Attribute Name	#Bytes	Format
0400h	MEDIUM MANUFACTURER	8	ASCII
0401h	MEDIUM SERIAL NUMBER	32	ASCII
0402h	MEDIUM LENGTH	4	Binary
0403h	MEDIUM WIDTH	4	Binary
0403h	ASSIGNING ORGANIZATION	8	ASCII
0405h	MEDIUM DENSITY CODE	1	Binary
0406h	MEDIUM MANUFACTURE DATE	8	ASCII
0407h	MAM CAPACITY	8	Binary
0408h	MEDIUM TYPE	1	Binary
0409h	MEDIUM TYPE INFORMATION	2	Binary
040Ah – 07FFh	Reserved		

The MEDIUM MANUFACTURER: Contains eight bytes of ACSII data identifying the vendor of the media.
Note: It is intended that the MEDIUM MANUFACTURER attribute provide a unique vendor identification of the manufacturer of the media. In the absence of a formal registration procedure, T10 maintains a list of known vendor identification codes in use. Vendors are requested to voluntarily submit their identification codes to T10 to prevent duplication of codes.

The MEDIUM LENGTH attribute specifies the length of the medium in meters. A value of 00h specifies that the length of the medium is undefined.

The MEDIUM WIDTH attribute specifies the width of the medium supported by this density. This field has units of tenths of millimeters. The value in this field shall be rounded up if the fractional value of the actual value is greater than or equal to 0.5. The MEDIUM WIDTH field may vary for a given density depending on the mounted medium. A value of 00h specifies the width of the medium is undefined.

The ASSIGNING ORGANIZATION attribute identifies the organization responsible for the specifications defining the values in the MEDIUM DENSITY CODE attribute. The ASSIGNING ORGANIZATION field should contain a value listed in the vendor identification list.
The MEDIUM SERIAL NUMBER identifies the manufacturer's serial number for the medium.

The MEDIUM DENSITY CODE is the same numeric DENSITY CODE as reported in the SCSI Mode Block Descriptor.

Note: The Formatted Density Code ID 0006h, which is in the Device Common Attribute section and the Medium Density Code ID 0405h, which is located in the Medium Common Attributes section, will need to be use in some cases in conjunction in determining the media format.

The MEDIUM MANUFACTURE DATE: Identifies the date of manufacture of the medium. The format is YYYYMMDD.

The MAM CAPACITY: Is the total capacity of the MAM, in bytes, at manufacture time. It does not indicate the free space of an unused medium auxiliary memory because some of the medium auxiliary memory space may be reserved for device-specific use making it inaccessible to the application client.

MEDIUM TYPE and MEDIUM TYPE INFORMATION: Gives information about non-data media and other types of media. The MEDIUM TYPE INFORMATION attribute is interpreted according to the type of medium indicated by the MEDIUM TYPE (table 12-12).
Note: Depending of the hardware vendor, this attribute may not be hard coded into the MAM at manufacture time.

Table 12-12: MEDIUM TYPE and MEDIUM TYPE INFORMATION attributes

MEDIUM TYPE	Description	MEDIUM TYPE INFORMATION
00h	Data medium	Reserved
01h	Cleaning medium	Maximum number of cleaning cycles permitted
02h-7Fh	Reserved	Reserved
80h	Write-once medium	Reserved
81h-FFh	Reserved	Reserved

Standard host type attributes

Application clients may sue the WRITE ATTRIBUTE and READ ATTRIBUTE commands to maintain the attributes shown in table 12-13. All existent host type attributes shall have a status of read/write.

Table 12-13: Host Common Attributes:

ID	Attribute Name	#Bytes	Format
0800h	APPLICATION VENDOR	8	ASCII
0801h	APPLICATION NAME	32	ASCII
0802h	APPLICATION VERSION	8	ASCII
0803h	USER MEDIUM TEXT LABEL	160	Text
0804h	DATE & TIME LAST WRITTEN	12	ASCII
0805h	TEXT LOCALISATION IDENTIFIER	1	Binary
0806h	BARCODE	32	ASCII
0807h	OWNING HOST TEXTUAL NAME	80	TEXT
0808h	MEDIA POOL	160	TEXT
0809h	PARTITION USER TEXT LABEL	16	ASCII
080Ah	LOAD/UNLOAD AT PARTITION	1	Binary
080Ch – BFFh	Reserved		

APPLICATION VENDOR: Contains eight bytes of ASCII data identifying the manufacturer of the application client (e.g. class driver or backup program) that most recently sent a WRITE ATTRIBUTE command to the device server while this medium auxiliary memory was accessible.

Note: It is intended that this field provide a unique vendor identification of the vendor who wrote the Host Common attributes. In the absence of a formal registration procedure, T10 maintains a list of vendor identification codes in use. Vendors are requested to voluntarily submit their identification codes to T10 to prevent duplication of codes.

APPLICATION NAME: Contains the name of the application client.

APPLICATION VERSION contains the version of the application client.

USER MEDIUM TEXT LABEL: Is the user level identifier for the medium.

DATE & TIME LAST WRITTEN: Contains when the application client last wrote to the MAM. The format for the string is YYYYMMDDHHMM using a 24-hour time format
Note: The application must update the “Date and Time Last Written” field any time the host attributes contents are modified.

TEXT LOCALISATION IDENTIFIER: Defines the character set used for attributes with a text format (table 12-14).

Table 12-14: TEXT LOCALISATION IDENTIFIER

00h	No code specified (ASCII)
01h	ISO/IEC 8859-1 (Europe, Latin America)
02h	ISO/IEC 8859-2 (Eastern Europe)
03h	ISO/IEC 8859-3 (SE Europe/miscellaneous)
04h	ISO/IEC 8859-4 (Scandinavia/Baltic)
05h	ISO/IEC 8859-5 (Cyrillic)
06h	ISO/IEC 8859-6 (Arabic)
07h	ISO/IEC 8859-7 (Greek)
08h	ISO/IEC 8859-8 (Hebrew)
09h	ISO/IEC 8859-9 (Latin 5)
0Ah	ISO/IEC 8859-10 (Latin 6)
0Bh – 7Fh	Reserved
80h	ISO/IEC 10646 (UCS-2BE)
81h	ISO/IEC 10646–1 (UTF-8)
82h – FFH	Reserved

BARCODE: Is the contents of a barcode associated with the medium in the MAM.

OWNING HOST TEXTUAL NAME: Indicates the host from which that USER MEDIUM TEXT LABEL originates.

MEDIA POOL: Indicates the media pool to which this medium belongs.

PARTITION USER TEXT LABEL: Is a user level identifier for the partition specified by the PARTITION NUMBER field in the CDB.

LOAD/UNLOAD AT PARTITION: Indicates whether the media can be loaded or unloaded at the Partition specified by the PARTITION NUMBER field in the CDB. If loads and unloads are enabled for the specified partition, the value of this parameter shall be one. If loads/unloads are not enabled for the specified partition, the value of this parameter shall be zero. All other attribute values are reserved. If LOAD/UNLOAD AT PARTITION is disabled, then loads and unloads are performed at the beginning of the media instead of at the specified partition. If this attribute is in the nonexistent state then the default action will be to load/unload at the beginning of media
Note:
The 0809h Partition User Text label and 080Ah Load/Unload at Partition Host attributes are optional. Supported, if the ISV supports multi partitions.

13. APPENDIX F: AIT based WORM system

13.1. Important Notice

(1) AIT WORM cartridges come equipped with Remote MIC.

(2) A new AIT WORM cartridge can be initialized to use either AIT native mode or DDS emulation mode.

(3) WORM features are supported in AIT tape drives with firmware revision level 0103 or later.

13.2. Write-Protected (WP) Bit in Mode Sense Data

Although the cartridge write-protected activator is permanently set to safe for all WORM media, the WP bit is not used in WORM mode and will be set to ZERO.

13.3. How to detect a WORM cartridge.

The WORM bit of AIT Device Configuration Page (31h) is used to indicate the presence of a WORM media.

Page 31h: AIT Device Configuration Page

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (31h)					
1	Page Length (8)							
2	AIT	DEV	ABS	ULP	PRT	PNJ	SYSLOG	
3	SPAN (0Ah)							
4	MIC	WORM	Reserved					
5	Reserved							WORM Capable
6	Reserved							
7	Reserved							
8	Reserved							
9	Reserved							

13.4. How to initialize a WORM cartridge.

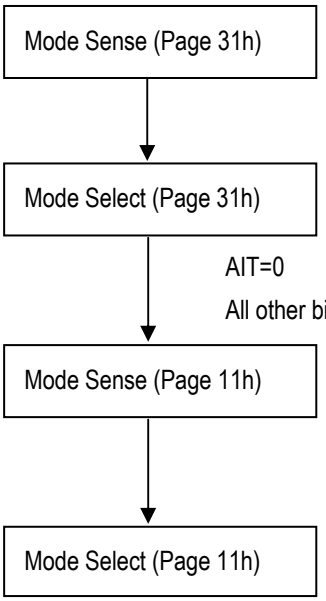
A new WORM cartridge can be initialized in two ways:

1. Mode Select Operation
2. Write Operation

Note: when using Write Operation (option 2), a new WORM cartridge will be initialized as one partition DDS emulation mode.

(i)How to initialize a WORM cartridge to DDS emulation mode.

1Partition



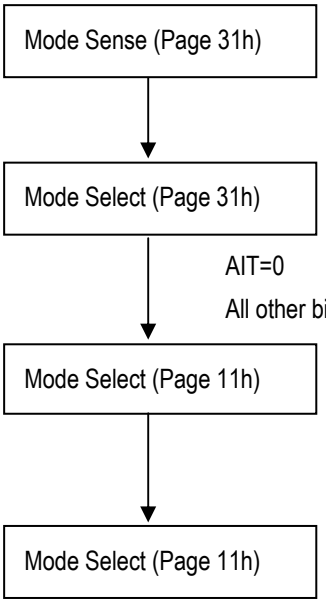
AIT=0

All other bits and bytes are the same as returned with Mode Sense Page 31.

Set IDP bit to 1. Additional Partition=0.

All other bits and bytes are the same as returned with Mode Sense Page 11.

2Parition



AIT=0

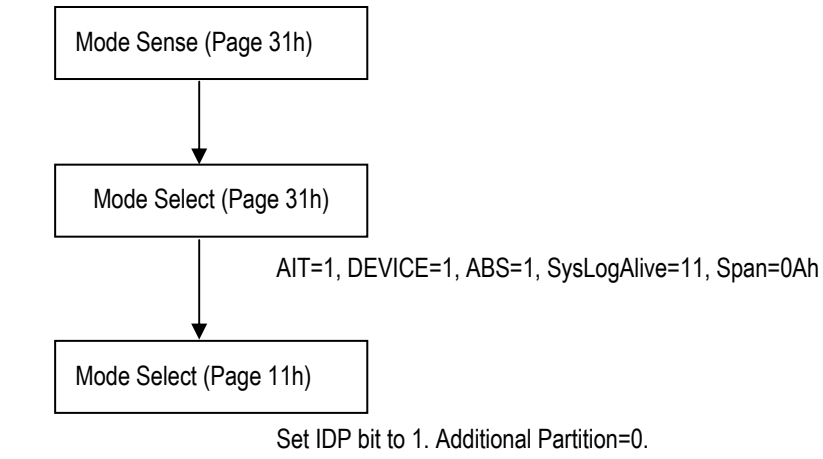
All other bits and bytes are the same as returned with Mode Sense Page 31.

Set IDP bit to 1. Additional Partition=1. Partition Size=non zero value

All other bits and bytes are the same as returned with Mode Sense Page 11.

(ii)How to initialize a WORM cartridge to AIT Native mode.

1Partition


Mode Sense (Page 31h)
Mode Select (Page 31h)
AIT=1, DEVICE=1, ABS=1, SysLogAlive=11, Span=0Ah
Mode Select (Page 11h)
Set IDP bit to 1. Additional Partition=0.

13.5. How to handle the WORM cartridge in the drive.

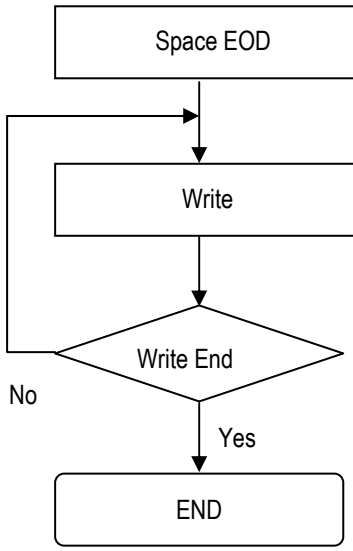
1. DATA READ: There is no restriction when reading data in WORM mode.
2. DATA WRITE: Any attempt to overwrite existing data will be rejected with a Check Condition status and sense data.
   - Write Projected Error: 07-27-00-07 (Sense Key, ASC, ASCQ, Run-time-error)
   - Append Position Error: 03-27-04-f7

The AIT WORM drive will allow write operations when:

(1) Append Write Operation is allowed only at End-Of-Data (EOD) area. Prior to an Append Write Operation, several commands can be used to position the drive at EOD area:

- Space to EOD (space code 3)
- Space to last record (could be a block, File-mark, Set-mark)
- Locate to last block
- Read until EOD

For example:



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14. APPENDIX G: DISASTER RECOVER

14.1. Overview

This chapter will outline the Disaster Recovery Firmware Specifications for Sony AIT drive and autoloader. This is applicable only to Windows NT/2000 Operating System. While in Disaster Recovery mode, the drive behaves as a bootable CDROM device. Using the DR tape image, users will be able to do a complete restore of the system.

14.2. Creating Disaster Recovery Tape

The Disaster Recovery tape must have the CDROM image of the operating system written first on the tape. This image is formatted in El Torito CDROM Boot Specification.

Disaster Recovery Tape can be created using Veritas BackupExec Software. Please follow instructions of Veritas BackupExec to create the DR tape. After the tape has been created, the tape must be write-protected to be considered DR tape.

14.3. Configuring The Drive For Disaster Recovery Operation

To enter DR mode, the tape drive needs to be configured with the following steps:

1. Insert a write-protected DR tape and wait for the drive to complete the loading sequence.
2. Observe the simultaneous flashing all LED. This is the DR standby mode. The drive will remain in this mode for a period of 15 seconds. Powering down the drive during this 15 seconds window will trigger the DR mode. The drive will exit the DR standby mode after 15 seconds and resume normal mode of operation. A SCSI reset will force the drive to exit the DR standby mode and service the SCSI reset.
3. Upon power up, the drive will enter the DR mode. Observe the simultaneous flashing LEDs of TAPE MORTION and CLEANING REQUEST. While in DR mode, a SCSI RESET will be treated as soft reset and will not take the drive out of DR mode.

Also, the drive will enter DR mode upon receiving a Mode Select command with Page Code 0x3C.

14.4. Exiting DR Mode

Ejecting the media via the front panel button or a SCSI UNLOAD command will exit the DR mode and restore the drive to normal operation. A SCSI Mode Select command with Page Code 0x3C and DREnable bit of zero will also exit the drive out of DR mode. On the autoloader, the DR mode indication on the 4th line of the LCD will disappear once the drive exits from DR mode.

14.5. Supported CDROM DR Command Set

14.5.1. Inquiry (12h)

5.1.1. Peripheral Device Type = 0x05 (CDROM)

5.1.2. Byte 43 = 0x24 (ASCII "$")

5.1.3. Byte 44-48 = "DR-10"

14.5.2. Read 10 (28h)

This command shall only be supported in DR mode. Execution of this command is in effect a translation of a LOCATE command and READ 6 (0x08) command executing in sequence.

14.5.3. Read Capacity (0x25)

This command shall only be supported in DR mode.

5.3.1. Returned LBA (Capacity) = 0004B000h (~640 Mbytes)

5.3.2. Block Length = 00000800h (2048 Bytes)

14.5.4. Read TOC (0x43)

This command shall only be supported in DR mode.

5.4.1. Returned Data (20 bytes)

00 12 01 01 00 14 01 00 00 00 00 00 00 14 AA 00 00 04 B0 00

14.5.5. Mode Sense/Select Page Code 0x3C

DR Mode Entry/Exit Page

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved	Reserved	Page Code = 3Ch					
Byte 1	Page Length = 04h							
Byte 2	Reserved							DREnable
Byte 3	Reserved							
Byte 4	Reserved							
Byte 5	Reserved							

DREnable: This bit reflects the status of the DR mode. When the drive enters DR mode, DREnable bit will be set to 1. This bit shall be reset to zero when the drive exits the DR mode. A Mode Select of Page Code 0x3C with setting of DREnable bit will force the drive to enter DR mode. With DREnable bit set to zero, the drive will exit the DR mode. Setting this bit to 1 when the tape is not write-protected shall be rejected with a Check Condition of Illegal Request (0x05) and ASC of 26h and ASCQ of 02h.

14.6. Reset Handling

While in DR mode, a SCSI reset shall not take the drive out of DR mode. A powered cycle will take the drive out of DR mode and return the drive to normal operation.

15. APPENDIX H: GLOSSARY

This glossary includes many terms that are useful when working with the SONY DDS tape drive. Not all terms are used within this manual.

Amble: A frame used to separate groups. It has a Logical Frame Number of ZERO. The Main Data Area contains only a valid header.

ANSI: American National Standards Institute, which sets standards for, amongst other things, SCSI and the safety of electrical devices.

ATF: Automatic Track Finding

Beginning Of Partition (BOP): The position at the beginning of the permissible recording region of a partition. If only one partition is defined, this position is typically equivalent to the beginning-of-medium. (BOM)

Beginning Of Medium (BOM): The extreme position along the medium in the direction away from the supply reel which can be accessed by the device.

Bit Error Rate: Number of errors/Total number of bits written or read

Block Error Rate: Number of errors/Total number of blocks written or read

BOM: Beginning Of Media

BOT: Beginning Of Tape

Buffered mode: A mode of data transfer in write operations which facilitates tape streaming, as reported in the Mode Select parameter.

Device Area: The first area on the tape used by the drive for drum spin-up and testing.

Drop-out: An area of tape where the signal level of the media has fallen off to a level where data recovery is no longer possible.

Early Warning: A device computed position near but logically before the end-of-partition. See the REW bit in the Mode Select Device Configuration page.

ECC: Error Correction Code

End Of Data (EOD): End of data in a partition a special format group written after all current user data.

End Of Medium (EOM): The extreme position along the medium in the direction away from the take-up reel which can be accessed by the device.

End Of Partition (EOP): The position at the end of the permissible recording region of a partition. May be the same as end of media.

EOD: End Of Data

EOM: End Of Media

EOP: End Of Partition

EOT: End Of Tape

Error Rate Log: The Error Rate Log exists in RAM in the SDX-900V and maintains a history of hard (un-correctable) and soft (correctable by RAW or C3 ECC) errors which have occurred since the last tape load.

Fast Searching: The process of reading just the ID areas to locate an item on the tape at a speed up to 75 times faster than normal read speed.

Fault Log: The Fault Log is stored in RAM in the SDX-900V and holds a record of Self-Test failures and all problems which have been met during normal operation.

Frame: Two adjacent tracks, one A channel and one B channel.

File-mark: A mark written by the host. It does not necessarily separate files. It is up to the host to assign a meaning to the mark. Consist of a special recorded element within a partition, containing no user data, which provides a segmentation scheme.

Group: A fixed capacity set of frames written onto or read from the tape. A group contains one index and can contain several records, partial records, File-marks and Set-marks.

Hard Error: A Hard Error is an un-correctable data error. During writing, this is defined as being uncorrected after the RAW retry limit has been exceeded. During reading, a hard error is logged if a group is un-correctable.

Head Clog: Particles from the tape or from outside the drive adhere to the head gap on a read or write head and obstruct the reading or writing of data. The particles will become dislodged by the operation of the internal head cleaner and/or cleaning tape.

Index: Information stored at the end of a group which specifies the contents of the group. Every group except the Vendor Group contains an index.

Lead-in Area: The first clause of the tape used for loading, BOT positioning, and tape usage logging.

Load: To insert a cassette into the drive. The drive automatically threads the tape and goes online.

LUN: Logical Unit Number, by which a device is identified on the SCSI bus. The Sony SDX-900V has an LUN of 0 fixed in the firmware.

MIC: Memory In Cassette.

Noise: Any kind of magnetic or electric interference detected by the electronics.

Off-line: The Sony SDX-900V is off-line if the tape is currently unloaded or not in the drive. The host has limited access, and cannot perform any commands which would cause tape motion. The host can, however, load a tape, if one is inserted, and can execute any diagnostic tests which do not require tape motion.

On-line: The Sony SDX-900V is online when a tape is loaded. The host has access to all command operations, including those which access the tape, set configurations and run diagnostic tests.

Over Length: The incorrect length condition that exists after executing a read command when the length of the actual block read exceeds the requested transfer length in the command descriptor block. Only the requested amount of data is returned to the host.

Partition: The entire usable region of recording and reading paths in a volume or in a portion of a volume. If there is more than one partition, they shall be numbered starting with ZERO (i.e., beginning of partition ZERO).

RAW: See Read-After-Write

Read-After-Write (RAW): Improves data integrity by reading data immediately after it is written and writing the frame again if an error is found. Frames are only re-written as necessary, so speed and capacity are affected minimally.

Repeat (N-group writing): Sometimes called multiple group writing, Repeat (N-group writing) repeats each group of data so that there are N consecutive copies of each group on the tape. This is a simple way of improving data integrity, but speed and capacity are sacrificed in writing all data several times.

Reserved: Reserved for future definition and detailing and not generally available for use. Reserved bits and fields should be set to ZERO.

Set-mark: A mark written by the host to allow fast searching to a point on the tape without having to know the number of records or file-marks that precede this point. A special recorded element within a partition, containing no user data, which provides a segmentation scheme hierarchically superior to file-marks for use in addressing or fast positioning on high capacity storage devices. (Also called Save-Set Mark)

SCSI (Small Computer System Interface): This computer device interface has been certified as an American National Standard by ANSI. The standard contains the electrical specifications, communication protocol, and command structure necessary to connect various computer peripherals to a host computer.

Soft Error: A soft error is a data error which can be corrected by a RAW rewrite during writing, or by C1, C2 or C3 ECC, or a read-retry during reading.

Spacing: The act of positioning the medium on a sequential access device.

System Area: A section in the Lead-in Area used to store the tape usage information.

Tape Log: The Tape Log contains details of the history of a tape, the total number of groups written, of RAW retries, of groups read, of C3 ECC retries, and of loads. The log is copied into RAM when the tape is loaded into the SDX-900V, updated as the tape is used, and written back into the System area on the tape when it is unloaded. Tape Write Protect, power failure or reset will losethe log data maintained in RAM.

Under Length: The incorrect length condition that exists after executing a read command when the requested transfer length in the command descriptor block exceeds the length of the actual block read.

Volume: A recording medium together with its physical carrier. (a single tape cassette)

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